



# McINTOSH

## MC2102 TUBE POWER AMPLIFIER

**M**cIntosh may not quite be the oldest name in audio, but it's certainly the most revered and has been ever since Frank McIntosh built his first amplifier, 'way back in 1949.

The reason for its immediate success was its Unity Coupled circuit design, which McIntosh invented, and for which he was granted a patent and which is still used in the MC2102. The Unity Coupled circuit made the McIntosh 50W1 one of the most powerful consumer audio amplifiers in the world at the time, but the real reason for its success was that it had the lowest distortion of any amplifier then available, and the widest bandwidth.

All this was possible because McIntosh had worked out how to deliver power from both the anodes and cathodes of his output

valves via special transformers with bifilar windings which needed only half the turns ratio required by conventional output transformers. This meant that for the first time, a consumer amplifier was able to deliver high power, low distortion and a flat, extended frequency response.

### The Equipment

The MC2102 has a lot in common with the original McIntosh, though it was designed and engineered only recently by Sidney Corderman who was called out of retirement in 1997, having retired in 1993 after working for McIntosh for 42 years. The clarion call came because McIntosh wanted a unique product to mark the occasion of the company's upcoming 50th anniversary in 1999.

Corderman had joined McIntosh fresh out of MIT. The amp he designed was the MC2000 Commemorative Edition, which was also a limited edition model, with only 559 ever made. The amplifier was so successful that Corderman hung around to design the MC2102.

The MC2101 is rated at 100-watts per channel but the channels can be bridged, turning the MC2102 into a 200-watt monobloc. Actually, the channels can be joined together two ways, via a three-position slide switch on the chassis next to the input connectors (about which more later). The three positions are *Stereo*, *Parallel Mono* and *Bridged Mono*. The MC2102 can be bridged to provide 200W mono into 16, 8, or 4-ohms, or the two channels can be run parallel to provide 200W into 4, 2, or 1-ohm. In the mono bridged mode, there's a phase inverter dropped into the input of one of the channels, so one channel is 180 degrees out of phase and the speaker is connected between the two 'hot' output terminals. This gives a fully balanced amplifier where the two output transformers are essentially turned into a single centre-tap unit.

The MC2102 has eight valves per channel. Balanced input and inversion is handled by a pair of 12AX7s, while twin 12AT7s provide voltage amplification and driver functions. Output valves are the famous KT-88s (although you can use 6550s). The output transformers have a number of different taps, so they can be matched to 2, 4 or 8-ohm loads for stereo operation or anywhere from 1 to 16-ohms as a monobloc. In fact, the enormous output transformers make up most of this amplifier's massive 40kg weight. McIntosh still winds all its own transformers in-house, using many of the original machines (though one suspects they're as original as your great grandfather's axe). Remember that to make these transformers, three transformer windings are required rather than the usual two. There are two primaries (one for the plates, one for the cathodes) and a secondary. The two primaries are spun bifilar (that is, two strands

wound together) for a close, turn-by-turn coupling. (Hence the name: unity-coupled output circuit.)

The power transformer is tapped for 100, 120 or 230V mains voltage, so you can use the amplifier anywhere in the world. In-rush current is controlled by thermistors, and the power supply uses a combination of four 1,000µF capacitors and a filter choke to ensure smooth clean d.c.

The most visible features of this amplifier are the two blue power meters on the front panel. In fact these meters (known as 'blue eyes' by McIntosh *aficionados*) are not on the front panel at all—they're behind it, because the front panel is made from clear glass. All the writing on the front panel is etched onto the rear of the glass. This is a very difficult way to make a front panel (it takes three days because the glass is cut using a high-pressure water jet cutter and each of the 12 layers of ink is UV cured before the next layer is applied), but there's a good reason, which is that the panel can be returned to 'as-new' with just a quick spray of Windex or any other ordinary glass cleaner.

Almost as visible are the two knobs on the front panel. The left-hand one controls the operation of the output level meters and the front panel's backlighting (though why you'd ever want to switch it off is beyond me). The right-hand one is the power switch (on, off, remote). Like pretty much everything McIntosh makes, these are highly unconventional, because they're not regular switches. Instead, they operate solid-state electromagnetic devices inside the amplifier which do the actual switching. The switches are not dissimilar to the reed switches used to connect doors and windows to burglar alarm systems, except that instead of using a permanent magnet to operate the switch, McIntosh winds a coil around the tube and uses d.c. current to energise the coil and create a magnetic field which in turn actuates the switch contact, opening or closing it as necessary.

Although valve amplifiers don't really go into hard clipping like their

solid-state counterparts (one of the reasons why valve amplifiers sound better than transistorised amps when they're operated close to their limits) McIntosh includes an 'anti-clipping' circuit it calls 'PowerGuard'. According to McIntosh, this '*provides real-time clipping protection without affecting power output or sound quality.*'

The rear of the McIntosh is unusual because for each channel there are four WBT speaker terminals. Of these, one goes to the 'negative' speaker terminal, then you choose one of the three remaining terminals for the 'positive' connection, depending on the nominal impedance of your speakers. There are both balanced (XLR) and unbalanced (RCA) input connectors, with a switch to choose between them. The other switch on the rear of the McIntosh is what's used to 'join' the two channels together, either in bridged mode or dual mono mode, as discussed previously. If you choose the bridged mode, not only does the power output capability increase to 200-watts, but also the minimum impedance the MC2102 can handle drops all the

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Brand: McIntosh  
Model: MC2102  
Category: Valve Power Amplifier  
Suggested Price: \$17,490.00  
Warranty Period: Three Years\*  
Distributor: Castel Electronics Pty Ltd  
Address:  
121 Beaufort Street  
Preston  
Victoria 3072  
Tel: (03) 9484 3788  
Fax: (03) 9486 3868  
Toll Free: 1800 505 051  
E-mail: [general@castel.com.au](mailto:general@castel.com.au)  
Web: [www.castel.com.au](http://www.castel.com.au)  
For additional information, turn to page 114 and circle 0201 on our Reader Information Service Card.  
\*Only one year warranty on valves.

way down to 1-ohm, a load that would be the death of almost all solid-state amplifiers. Oh, a note. Be careful with these WBT terminals, because they have a 'double action' thread, where the top nut tightens on banana plugs and the bottom nut tightens on cable or pin connectors. If you don't loosen the top nut, for example, you won't be able to insert plugs at all!

A complaint that's becoming more common in audiophile (and other!) circles is that *'They don't make them like they used to.'* However true that statement might be about many hi-fi brands, it could never be said about McIntosh's products because basically they've been building them exactly the same way for the last 50 or so years. While the company has upgraded circuitry as better components have become available (metal film resistors, polypropylene capacitors, etc) McIntosh has made absolutely no attempt to make its products 'cheaper'. It doesn't even produce a 'budget' line, for example.

Just in case I've given you the idea that McIntosh has been making valve amplifiers all these years, I should disabuse you of this, because it isn't true. McIntosh started designing and building solid-state amplifiers almost the minute transistors became available, commencing with the C24 preamplifier in 1964. Interestingly, the company's 1700 receiver, also produced in 1964, was a hybrid, but not the hybrid you'd expect. In this receiver it was the tuner section that used the valves: the pre-amp and amplifier sections were solid state!

It's a source of some consternation to *aficionados* of McIntosh's valve designs that the current McIntosh 'look' actually stemmed from a solid state model, the MC2505, which was the first separate solid state power amplifier ever made by McIntosh. This amp introduced the all-glass front panel, the illuminated output level meters, the Sentry Monitor circuitry and the McIntosh 'autoformer'. I

should confess at this point that this amp was also the first McIntosh I ever experienced (I regret to say that I couldn't afford to buy it.)

### Listening Sessions

My McIntosh MC2102 came in its original shipping package, so I had to get it out myself (which revealed to me—and my chiropractor—that it's really a two-person job!) and then plug in all the valves. Generally, I'd imagine that McIntosh dealers will deliver and install the MC2102, so you won't have to worry about this, but if you do, can I recommend you don't handle the valves with your fingers? It doesn't matter if you do use your fingers (otherwise dozens of valves I've replaced over the years would never have lasted as long as they did) but you'll find that if you do, you'll get fingerprints on them that could be hard to shift after the valves have heated up.

It's often recommended that you use white cotton gloves (and indeed McIntosh provides a pair for you), but I find these can be slippery, making it tricky to grasp the valve without running the risk of dropping it. I used a new, dry 'Chux'-style dishwashing cloth to grab mine. Just to be on the safe side, I'd install all the valves while the MC2102 is still on the floor (preferably carpeted) so that if you do drop a valve, there's no chance of a breakage.

I am quite used to valve amplifiers running hot, which is nothing less than you'd expect, particularly if, like me, you've owned a few in the past, but I found that the MC2102 was like a small furnace! It turns out that the eight KT88s are driven with fixed bias, and because of the cathode arrangement, each one is driven by about 170-volts. When you factor in the added heat from the four 12AX7 input valves and four 12AT7 valve drivers, you're looking at quite a hand-warmer. After only a few hours of operation, the metal cage that protects the 16 valves became almost too hot to touch. (Actually very few

photographs of the MC2102 show this cage, because the amp looks so great without it, and you don't really have to fit it at all if you don't want to. I suppose it depends on your home situation. If, for example, children are likely to have access to the amplifier, I'd recommend ALWAYS using the cage.) My understanding was that the KT88s used in the MC2102 were made for McIntosh by Svetlana (Russia) but the ones in mine seemed to be made in China. I love the sound of KT88s (NOS rather than newly manufactured), but if you're a 6550 person, McIntosh is happy for you to substitute.

McIntosh is not unaware of the problem with heat, because in its (absolutely excellent!) instruction manual, it suggests you may care to cut a hole in the table, bench or shelf that's supporting the MC2102, to allow air to come up from immediately underneath the amplifier. This is a great idea unless, like me, you put the MC2102 on a polished antique table! Needless to say, if you're one of those people who likes positioning their amplifier on the floor between their speakers, I certainly would not recommend this if your floor is carpeted.

When I was burning the MC2102 in (an entirely appropriate expression in this case!) I kept an eye on the power meters, because the test discs I use for burn-in have a wide range of signals, and I was interested to see how accurate the meters were, despite the fact that it's my personal opinion that power output meters on amplifiers are of very little practical (if any!) use—though I suppose they could alert you to the presence of infrasonic or ultrasonic signals. It seemed to me that the meters responded very fast and very accurately with tonebursts, impulses and pink and white noise, though I didn't have access to any test equipment to verify the exact speed of the needles, or the calibration accuracy of the meter markings. I'd have to warn that the accuracy of the meters would also depend to a large extent on the speakers you use, and the particu-

lar transformer tap you choose to drive them. I guess the problem for McIntosh is that it's been fitting them for so long that they've become almost a trademark for the company, so that a McIntosh wouldn't be a McIntosh without those ol' Blue Eyes!

Having owned a few valve products in the past (Williamson, Quad, Audio Research and, most famously in my youth, two Lenard valved musical instrument amps wired as a high-power stereo!) and had a McIntosh on long-term loan, I was looking forward with intense anticipation to hearing this new McIntosh, so much so that I didn't burn it in for my usual length of time because I literally couldn't contain myself, so keen was I to hear real music. When I did, I entered seventh heaven, because not only did this new McIntosh have the exact same classic McIntosh sound I remembered from years ago, it also had that magical 'valve' sound!

What is the magical valve sound? I don't think I've ever seen it put into words in a way that made it understandable, so I'm reduced to saying that for me (and for whatever reason), music seems to sound more relaxed and easy to listen to than the same music through a solid-state amp. The bottom line, I guess, is that it's more enjoyable. The music acquires a special warmth and depth—more so from LP than from CD, it must be said, but it also gives CD sound a lustrous ambience that eludes the solid-state brigade—even those using supposedly 'valve-like' devices, such as MOS-FETs. The jury is out on why valve amps sound so good. Some say it's the inherent distortion, some say it's the microphonics, some even claim it's all an auditory illusion (can't believe this last!). All I can say is that if it sounds this good, who cares?

However, the best is probably yet to come because I also have to tell you that the McIntosh MC2102 did not exhibit most of the limitations that most people claim affect valve amplifiers. For example, some say valve amplifiers sound

'soft' because their frequency response rolls off early. There was absolutely no evidence of this with the MC2102, because the treble sound was smooth and extended to well beyond audibility, and that was even when playing DVD-A and SACDs using extended-bandwidth speakers. As for microphonics, I couldn't induce any microphonic effects, even when I placed the amplifier directly in front of the speakers and turned up the volume to ear-shatteringly loud levels. And when I say 'ear-shatteringly' loud, I suspect I've telegraphed the fact that the McIntosh doesn't have any power limitations either! The volume just seems to go up and up ... and up. In the end, I hooked up my most inefficient speakers, donned some hearing protection (30dB attenuation) and deliberately overdrove the MC2102. The sound didn't become rough; it didn't even begin to sound strained—it just got louder and louder. Eventually I stopped only because I feared for my loudspeakers.

I can't conclude this review without a short comment on valve life, because the modern generation of electrical engineers, many of whom have probably never seen a valve in their life, always seem to overstate their fragility and understate their service life. You can get the best idea of the robustness of valves when you realise that most guitar amps still use valves, and if you've seen roadies loading and unloading band equipment, you'll know they get some pretty (very!) rough handling. Since the valves in a guitar amp can withstand being loaded and unloaded three or four nights a week, every week, for many years, the valves in a hi-fi amp are obviously living the life of Riley, by comparison. As for longevity, think along the lines of not hundreds of hours, or even tens of hundreds of hours, but upwards of eleven thousand hours. That's five hours a night, every night, for more than five years, after which you just replace the valves yourself in a few minutes if it's necessary (and it may not be—

valves have been known to last much, much longer. I once inherited some valves—still working—from an amp my father-in-law had built in the 50s, and used them for nearly ten years!)

## Conclusion

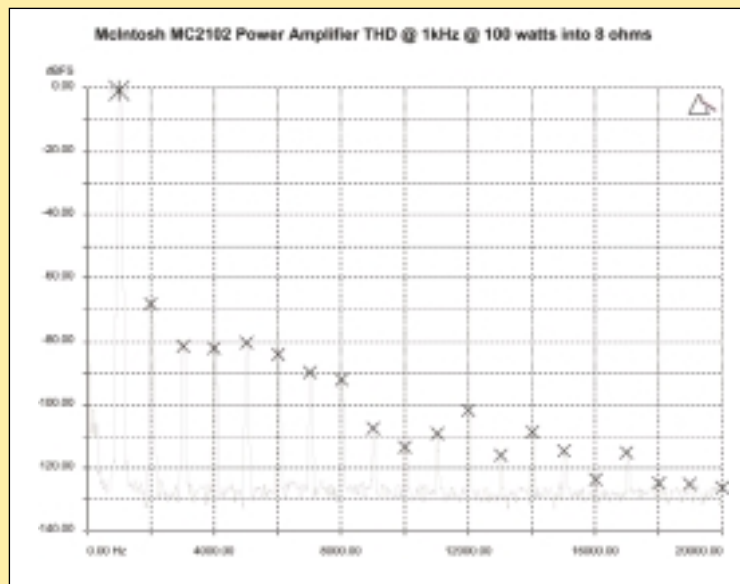
When pondering how to sum up my feelings about this McIntosh, it occurred to me that there are some readers who will imagine that asking a valve amplifier buff whether he likes the MC2102 is a bit like asking a woman whether she'd fancy a Cartier necklace, or a performance car freak whether he'd like a Ferrari, at which point I suddenly realised that all three purchases have something in common—and I'm not talking about the obvious! With all three, you're buying a slice of history; something that will endure. The MC2102 is valuable, in the true sense of the word. It will be handed down to your children, and your children's children. More important (at least for you) is that every time you switch it off after an evening of musical pleasure you'll know you made the right decision! **AHF**

*Andy Brown*

## LAB REPORT

Readers interested in a full technical appraisal of the performance of the McIntosh MC2102 Power Amplifier 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.





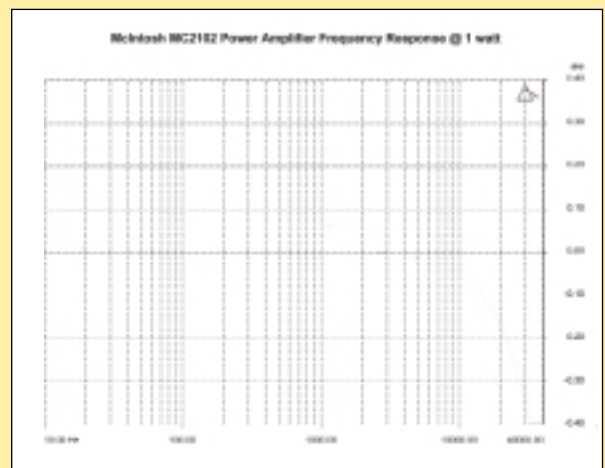
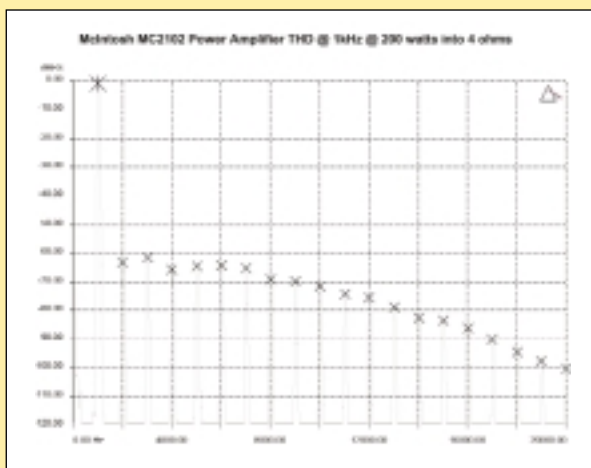
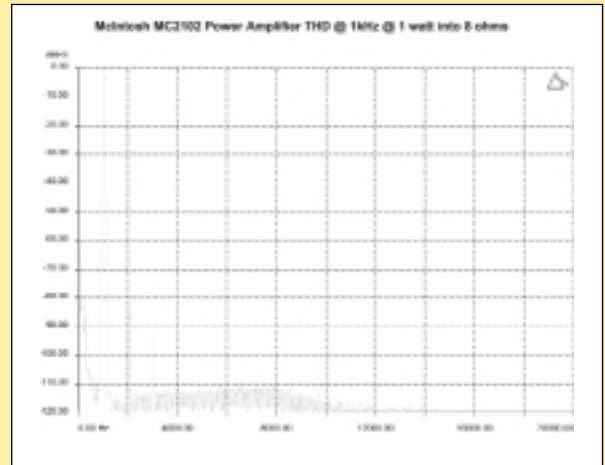
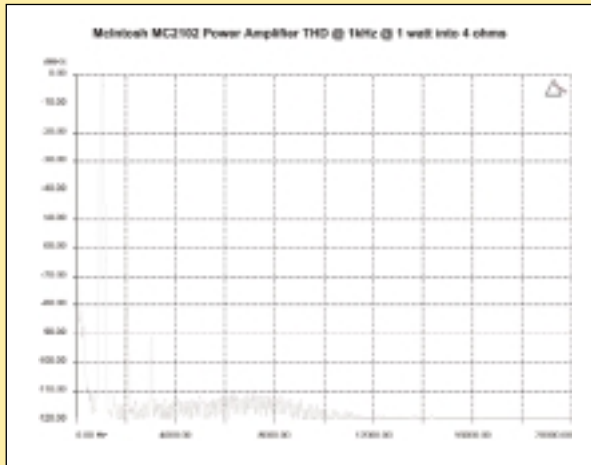
### Strange but True

When Apple Computer developed its ground-breaking Macintosh computer, it didn't want any legal stoushes complicating the launch, so it entered into a license agreement with McIntosh which ran for 10 years and allowed Apple Computer to use the Macintosh name in connection with computer products. Apple decided it should do this even though the two products were not only not related, but weren't even spelled the same way. Apple even paid McIntosh a license fee, although the amount has never been disclosed. Take a look around the back of a Macintosh Plus and you'll see a label that says: 'Apple and the Apple logo are registered trademarks of Apple Computer, Inc. Macintosh is a trademark of McIntosh Laboratory, Inc. and is being used with express permission of its owner.'

### Test Results

Australian HI-FI Test Laboratories ran two sets of power output tests using different transformer taps. As expected, the McIntosh MC2102 returned the best performance (which was in excess of its rated specifications) when the tap value matched the impedance (or rather in this case, *resistance*, seeing that the lab uses high-power non-inductive dummy loads). The results have been tabulated in the appropriate tables, but you can see that into 8-ohm loads, using the 8-ohm tap, the MC2102 delivered more than 120-watts continuous per channel with both channels driven, and around 130-watts per channel

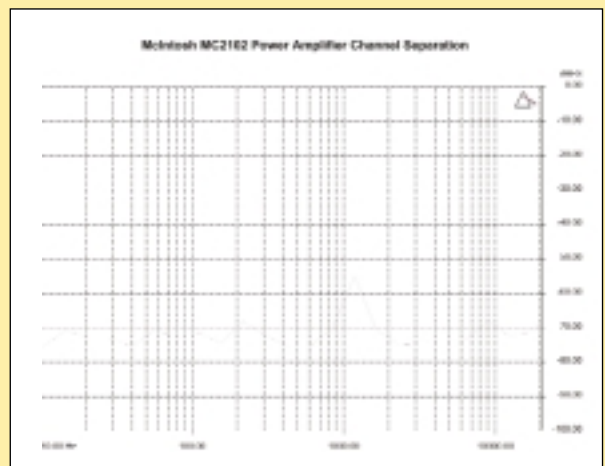
continuous with just a single channel driven. When the resistance was dropped to 4-ohms on this same tap, output increased with just a single channel driven to 161-watts at 1kHz and 147-watts at 20Hz, but the protection triggered with a 20kHz test signal. With both channels driven, the MC2102 delivered 118-watts per channel at 20Hz, 136-watts per channel at 1kHz, and the protection triggered again when the amplifier saw a 20kHz signal. This means that in practical situations, where the impedance of a speaker at 20kHz is likely to be higher than 8-ohms, you'll get the benefit of high power at low fre-

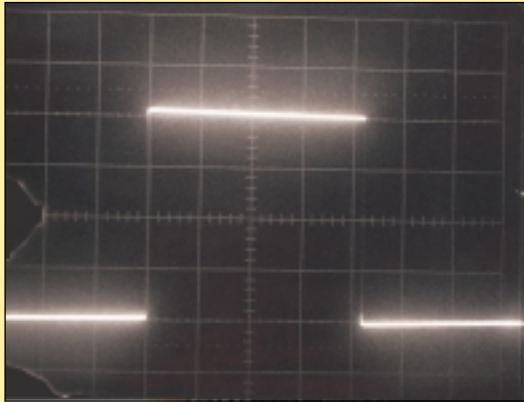


quencies, but the protection won't trigger at higher frequencies, even for the same power level.

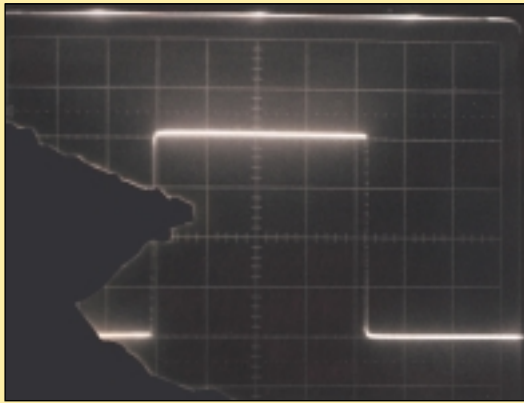
The power output results for the 4-ohm tap show that if you use 4-ohm speakers, you'll get 128-watts per channel, both channels driven, at low frequencies, decreasing slightly to 123-watts at 1kHz and 115-watts at 20kHz. (Note from the dBW column that the spread is a mere 0.4dB!). With 8 ohm speakers, the mismatch has more effect on power output than when mismatching 4-ohm speakers to the 8-ohm tap, such that power output drops to around 90-watts continuous. Note, however, that the protection doesn't trigger in this case. However, since the protection wouldn't trigger in real life situations, as described in the previous paragraph, this is a moot point.

Frequency response is flat, and very extended. The asterisk in the copy alongside the 1Hz measured lower limit is a note that it was impossible to get a stable reading of exact level at this fre-

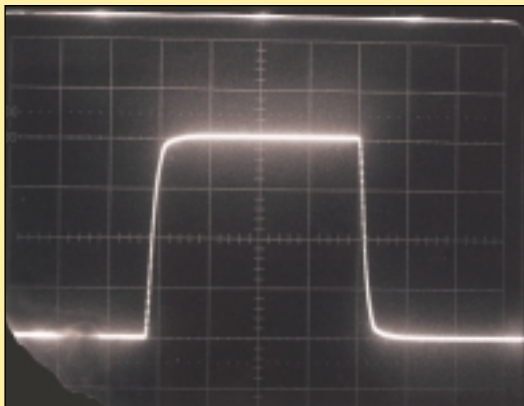




Square Wave Response  
Frequency: 100 Hz  
(8  $\Omega$  resistive load)



Square Wave Response  
Frequency: 1 kHz  
(8  $\Omega$  resistive load)



Square Wave Response  
Frequency: 10 kHz  
(8  $\Omega$  resistive load)



Square Wave Response  
Frequency: 1 kHz  
(8  $\Omega$ /2  $\mu$ F capacitive load)



quency, so this is an approximation. The upper limits of 55Hz (-1dB) and 123kHz (-3dB) show this amplifier would benefit from a wide-band source such as DVD-A or SACD. The graphed frequency response shows a slight (0.02dB) boost in response below 20Hz, due to the transformer after which it's better than 0.01dB up to 3kHz, where it gradually rolls off to be 0.05dB down at 10kHz, 0.1dB down at 16kHz and 0.18dB down at 20kHz. Into a simulated loudspeaker load (the red trace), the McIntosh's response was not nearly so flat, although it was still comfortably within 0.01dB from 10Hz to 15kHz and only -0.18dB at 20kHz! As you can see, there are peaks at 60Hz and 1.8kHz of around +0.07dB and dips at 200Hz (-0.02dB) and 4.8kHz (-0.08dB). These are nothing to get excited about, but could conceivably have an effect on the sound of the amplifier.

The distortion spectrum at one-watt output was interesting more for the noise floor at -115dB than for the distortion products, which amount to only 2nd and 3rd harmonics. With 8-ohm loads, HDL<sub>2</sub> is -85dB (0.005%) and HDL<sub>3</sub> is at -95dB (0.001%), but with 4-ohm loads, the levels

creep up slightly, to -80dB (0.01%) and -90dB (0.003%) respectively, which would seem to indicate that you'll get slightly lower distortion with 8-ohm speakers (and tap) than with 4-ohm speakers.

Distortion increased quite dramatically at rated output, though again the 8-ohm tap/speaker matching gave better results than the 4-ohm tap/speaker combination. The accompanying graph shows harmonic distortion components out to the 17th (though admittedly this is at -117dB). It seems likely that the levels of second harmonic distortion at -70dB (0.025%) and the 3rd, 4th and 5th all at around -80dB (0.01%) would have an effect on the sound. The graph showing distortion into 4-ohms looked to me a little like the amplifier was clipping slightly, rather than 'ordinary' distortion but I couldn't request a re-test because unfortunately by the time I got to see this graph the amplifier had been returned to the distributor.

Channel separation was moderately good, as you can see on the graph (and in the tabulated results), being pretty much better than 70dB right across the band, with one small 'blip' at 1.2kHz to -55dB. I suspect this could have been interference break-through from something else in the lab, possibly a computer monitor. Balance between the channels was excellent, at 0.0458dB. Interchannel phase was unmeasurably low which would have been good for a solid-state amplifier, but for a valve unit, it's truly exceptional!

Signal-to-noise ratios were excellent, though solid-state power amplifiers are rather quieter, but no-one could complain about the weighted figures of 90dB (IHF-A) referenced to one-watt output and 108dB (IHF-A) referred to rated output, especially since many owners will use a passive pre-amp, or possibly connect a CD or DVD player directly to the McIntosh, cutting out a lot of extraneous circuitry.

The editor says he's been coping a lot of flak because I haven't been including the square wave

**Power Output Table 1** (McIntosh MC2102 Power Amplifier — 8-ohm tap)

Channels Driven	Load	20Hz	2kHz	20kHz
1	8Ω	136 (21.3)	136 (21.3)	128 (21.0)
2	8Ω	127 (21.0)	121 (20.8)	127 (21.0)
1	4Ω	147 (21.6)	161 (22.0)	Pro (N/A)
2	4Ω	118 (20.7)	136 (21.3)	Pro (N/A)

Note: Figures in brackets are dBW—decibels referred to one watt)

**Power Output Table 2** (McIntosh MC2102 Power Amplifier — 4-ohm tap)

Channels Driven	Load	20Hz	2kHz	20kHz
1	8Ω	90 (19.5)	90 (19.5)	96 (19.8)
2	8Ω	84 (19.2)	89 (19.4)	89 (19.4)
1	4Ω	136 (21.3)	132 (21.2)	128 (21.0)
2	4Ω	128 (21.0)	123 (20.9)	115 (20.6)

Note: Figures in brackets are dBW—decibels referred to one watt)

**Test Results**

Freq. Resp. @ 1 watt (-1dB):	1.0Hz*– 55kHz
Freq. Resp. @ 1 watt (-3dB):	1.0Hz*– 123kHz
Channel Separation @ 1kHz:	61dB/73dB
Channel Separation @ 20Hz:	68dB
Channel Balance:	0.0458dB
Interchannel Phase:	0.0 degrees
THD+N @ 1 watt:	0.010%
THD+N @ 100 watts:	0.028%
S/N Ratio (re 1 watt out):	78dB (unweighted)
S/N Ratio (re 1 watt out):	90dB (IHF A-weighted)
S/N Ratio (re rated o/pt):	97dB (unweighted)
S/N Ratio (re rated o/pt):	108dB (IHF A-weighted)
Input Sensitivity (CD input):	2.3mV (for rated output)
Input Sensitivity (CD input):	236mV (for 1 watt out)

oscillograms, so I've included the set for the McIntosh MC2102 and as you can see, they're excellent. Note particularly the response at 100Hz which exhibits no phase shift whatsoever and only a tiny tilt indicating a non-d.c. response. Also note the 10kHz square wave's outstanding rise time and minimal rounding. As you'd expect,

response into a capacitive load is very well-controlled, with only about a one-third overshoot. The few cycles of ringing are damped very quickly. The 1kHz wave is excellent (the triangular part on the right was the fault of the Polaroid camera). There's some tiny rounding, but that's being very picky!

Steve Holding 