Electronic Laboratories'

SPECIAL REPORT

Electronic Laboratories looks at the only Digital Ready Amplifier

The world's finest amplifier turns out to be the world's only Digital Ready Amplifier.

This report answers these important questions:

1. What does it mean to be Digital Ready?

2. What do Digital Discs do to all other amplifiers?

3. Why do McIntosh Amplifiers alone escape digital sonic overload?

HERE'S WHAT IT MEANS TO BE "DIGITAL READY"

Compact Discs have been proclaimed to have a large increase in "dynamic range". Dynamic range is the ratio, usually given in decibels, between the softest, quietest sound on the disc and the loudest. Most Compact Disc or digital disc players claim a dynamic range in excess of 90 decibels. In numerical ratio this is greater than 1000 times the ratio of practical conventional analog records.

However, what is really important is the signal to noise ratio. This ratio either is, or can be, 94 decibels. In practical terms it really means there is no "hiss", no "clicks" and no "pops" audible from the Compact Disc. Because the noise "floor" is close to being inaudible, it is really possible, practical, and enjoyable to listen to Compact Discs at much louder levels than we could ever listen to analog records. This is why preamplifiers and power amplifiers are often subjected to "digital sonic overload". The effect is a harsher sound on the louder passages.

It is relatively easy to design a preamplifier with a great measure of overload capacity. 10 decibels of overdrive capacity is common. But in power amplifiers, 10 decibels of overdrive protection means 10 times the power capacity for which the amplifier was designed! A 250 watt per channel stereo amplifier would need to deliver 2500 watts of low distortion capacity to escape "digital sonic overload"!

For equipment to be "digital ready" it must be able to handle overdrive without "break up" or grossly distorting the sound. With one exception all power amplifiers today are incapable of accepting 10 decibels of overdrive without gross distortion. Some amplifiers totally collapse under this punishment from Compact Discs.

For the past year we have observed that McIntosh amplifiers alone escape "digital sonic overload". We have devised a test which illustrates this problem and displays the severity of the overdrive in all other amplifiers. This test measures the spectral fidelity of amplifiers under stress. Stress is applied at 3 decibels, 6 decibels and where possible 10 decibels of overdrive while measuring, visually observing, and audibly sensing the resultant spectrum.

In all but one amplifier design tested, the level of discordant components in the amplifier output increased to amounts measuring in the 30% or 40% range. The audible effect is dramatic.

SPECTRAL FIDELITY INTERMODULATION TEST

Here's how your amplifier is tested:

Two tones, 14 kHz and 15 kHz, are fed to the input of the amplifier under test. The output of the amplifier is fed to a resistive dummy load across which an A.C. voltmeter is connected, (to allow computation of the amplifier's output power), and to a spectrum analyzer which displays the magnitude and frequencies of signals at the amplifier output.

Ideally, only the two test tones should be reproduced at the amplifier output. Some amplifiers generate an intermodulation spectrum of tones corresponding to the sum and difference of the test tones. These spurious tones are called Intermodulation Distortion.

All amplifiers (McIntosh amplifiers with Power Guard* are the only exception), produce such a spectrum when they are driven beyond their output capacity. They produce Intermodulation and Harmonic Distortion, the severity of which depends on the amount of overdrive and the design of the amplifier. Distortion of 30% or greater is not uncommon. Most of the spurious frequency components are at high frequencies and can easily destroy the tweeter sections of loudspeakers.

The exclusive and unique McIntosh Power Guard* design alone prevents amplifier overdrive, and prevents excessive distortion. The Power Guard* circuit becomes a *digital sonic overload corrector* and prevents the distortion spectrum from exceeding an average of 0.3% for stresses up to 10 decibels. All other tested amplifier designs produce distortion spectrum power in the 20% to 40% range.

*(U.S. Patent #4048573)

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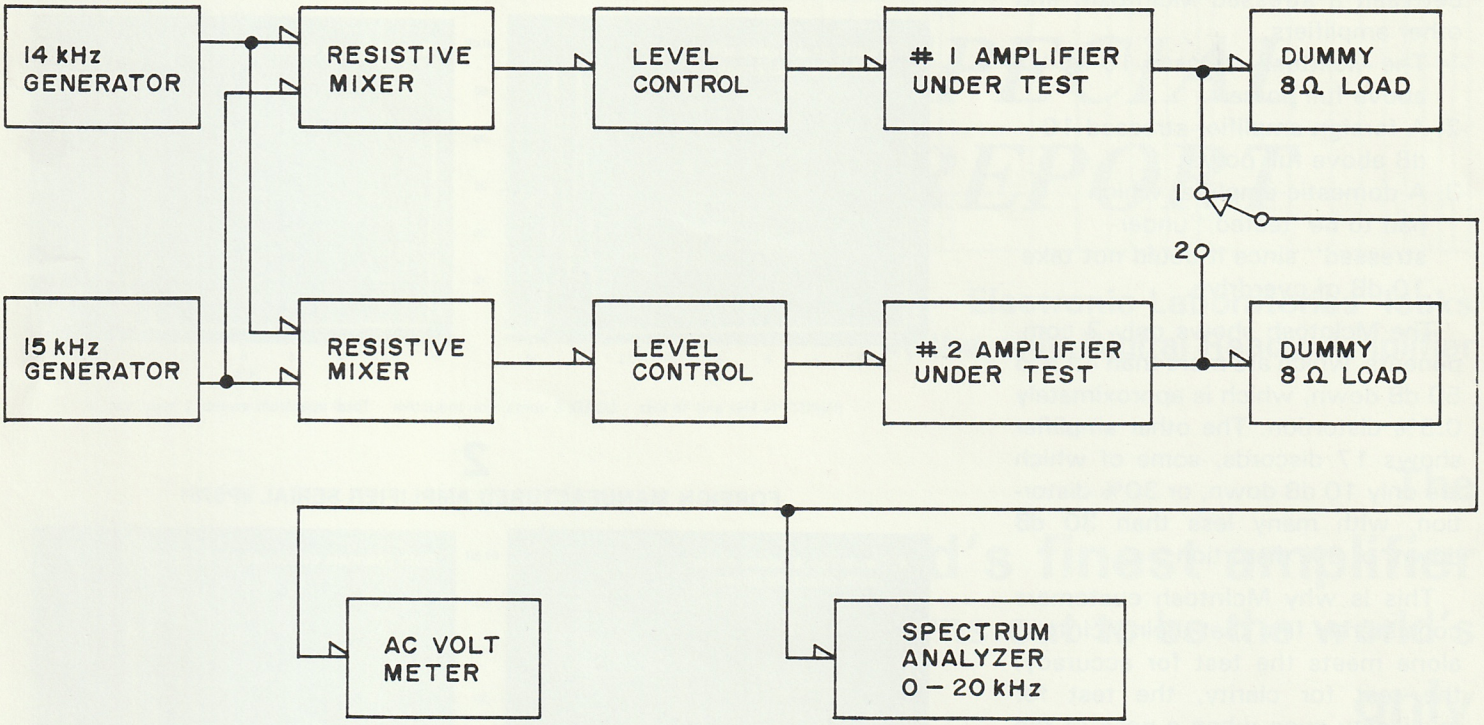
TEST SETUP FOR MEASURING SPECTRAL FIDELITY TESTING PROCEDURE



In this test set up the performance of two amplifiers can be compared. Each can have its input level adjusted independently to obtain rated power output. Then, using a switch on the adjustable level control circuit, each amplifier can be overdriven 3 dB, 6 dB or 10 dB (3 dB corresponds to asking the amplifier to produce twice its rated output, 6 dB is four times its rated output and 10 dB is ten times the rated output).

The AC voltmeter displays voltage which is used to compute the power output of the amplifier. Since an 8 ohm load is used, the formula for determining the average power output is:

$$P = \frac{V^2}{8\Omega}$$

when one tone is used. Since two tones of equal magnitude are used, the "equivalent average" power output formula is:

$$P = \frac{2V^2}{8\Omega}$$

The following chart shows voltages and the equivalent power output for this Intermodulation Test.

AC Volts (RMS)	Equivalent Average Power Output in Watts
10.0	25
14.1	50
17.3	75
20	100
24.5	150
28.3	200
31.6	250
44.7	500

The spectrum analyzer horizontal calibration is linear in frequency, 0 Hz at the left and 20 kHz at the right with 2 kHz spacing between calibration lines. The vertical calibration is in dB with 0 dB at the top and −90 dB at the bottom. There is 10 dB spacing between calibration lines. The analyzer has an 80 dB noise threshold, so noise on the base line below 80 dB can be disregarded. The percentage of distortion for any single spurious output is determined by:

$$\text{\% Distortion for Single Component} = \frac{\text{V Component}}{\sqrt{Vf_0^2 + Vf_2^2}}$$

The chart shows the distortion of spurious components when using the dB scale on the spectrum analyzer. The measurement of the spurious component is described by the number of dB below the 0 dB reference level of the original two test tones.

dB Below 14 kHz and 15 kHz	% Distortion Of Spurious
0 dB	71 %
−5	40
−10	22
−15	13
−20	7.1
−25	4.0
−30	2.2
−35	1.3
−40	0.71
−50	0.22
−60	0.071
−70	0.022
−80	0.007

In these oscillograms, you can see the difference in Spectral Fidelity between a stressed McIntosh, and other amplifiers.

1. The McIntosh stressed 10 dB above full power
2. A foreign amplifier stressed 10 dB above full power
3. A domestic amplifier which had to be tested "understressed" since it could not take 10 dB of overdrive.

The McIntosh shows only 3 components, which are more than 44 and 50 dB down, which is approximately 0.3% distortion. The other amplifier shows 17 discords, some of which are only 10 dB down, or 30% distortion, with many less than 30 dB down, or 3% distortion.

This is why McIntosh customers consistently find that their McIntosh alone meets the test for accuracy, the test for clarity, the test for musicality even when a peak of ten times the power demand suddenly smashes into the power amplifier.

When other amplifiers are similarly stressed they generate large quantities of discordant sounds destroying the real musicality of the reproduced instruments.

Note in oscillogram number (3) the complete failure of one of the most popular of American amplifiers. If 14 and 15 kHz are amplified at the same time the amplifier shuts down by "motor boating". It was necessary to lower the frequency of the test signals to 10 and 11 kHz to even complete the test or to perform the test at less than half rated power on this domestic amplifier.

It is no accident that McIntosh amplifiers sound better.

It is no accident that a McIntosh is a better investment.

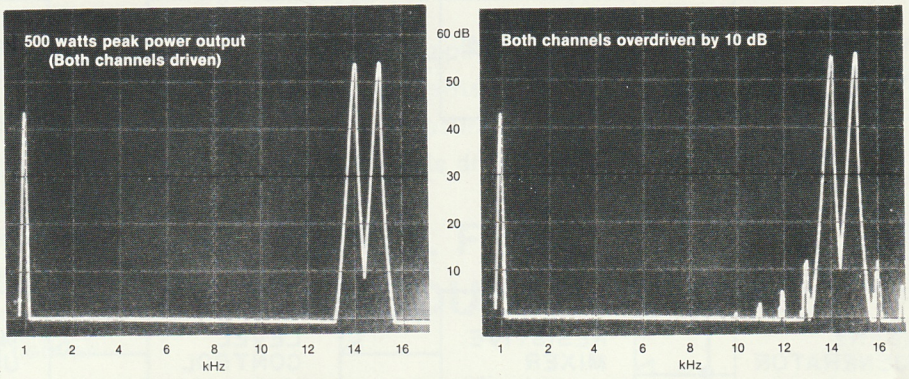
- **It sounds better**
- **It is more reliable**
- **It lasts longer**
- **Its resale value is the highest**

If good enough will do, there are at least 100 answers for you. But if the best is what you need then there is only one real answer.

McIntosh---the amplifier that in 40 years has outlived 60 others who have simply faded away.

1

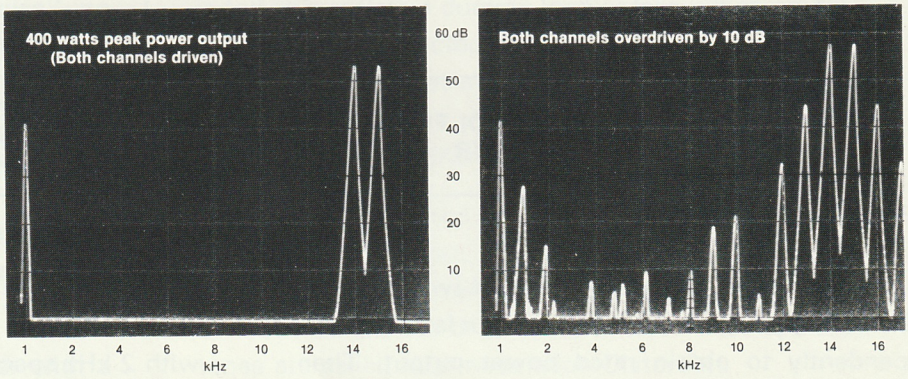
McINTOSH MC 2255 POWER AMPLIFIER



(INPUT: 14 kHz and 15 kHz - LOAD: 8 ohms, non inductive - Total spectrum sweep, 2 seconds)

2

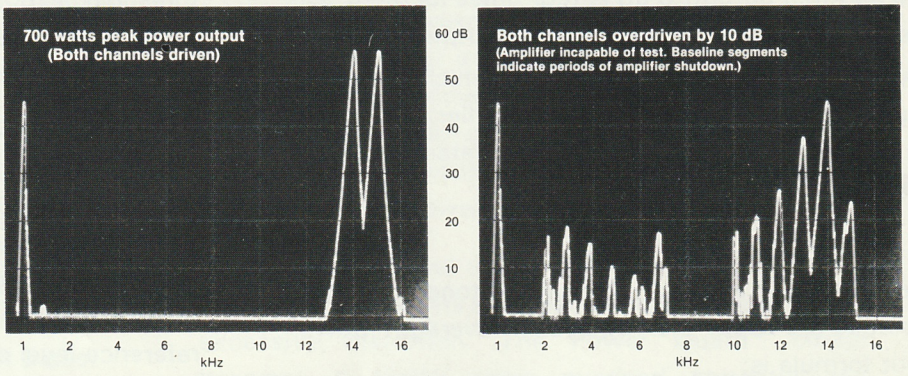
FOREIGN MANUFACTURED AMPLIFIER SERIAL #P6781



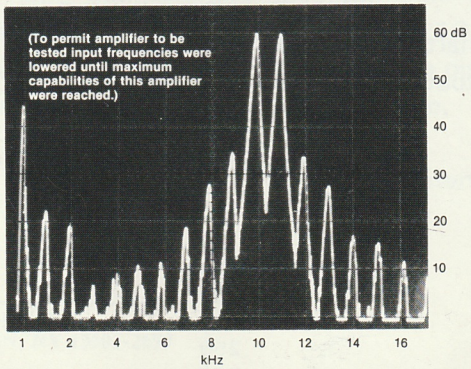
(INPUT: 14 kHz and 15 kHz - LOAD: 8 ohms, non inductive - Total spectrum sweep, 2 seconds)

3

DOMESTIC MANUFACTURED AMPLIFIER SERIAL #0595



(INPUT: 14 kHz and 15 kHz - LOAD: 8 ohms, non inductive - Total spectrum sweep, 2 seconds)



(INPUT: 10 kHz and 11 kHz - LOAD: 8 ohms, non inductive - Total spectrum sweep, 2 seconds)