PRODUCT *ANALYSIS*

Electronic Laboratories looks at the McIntosh MR 78 Tuner

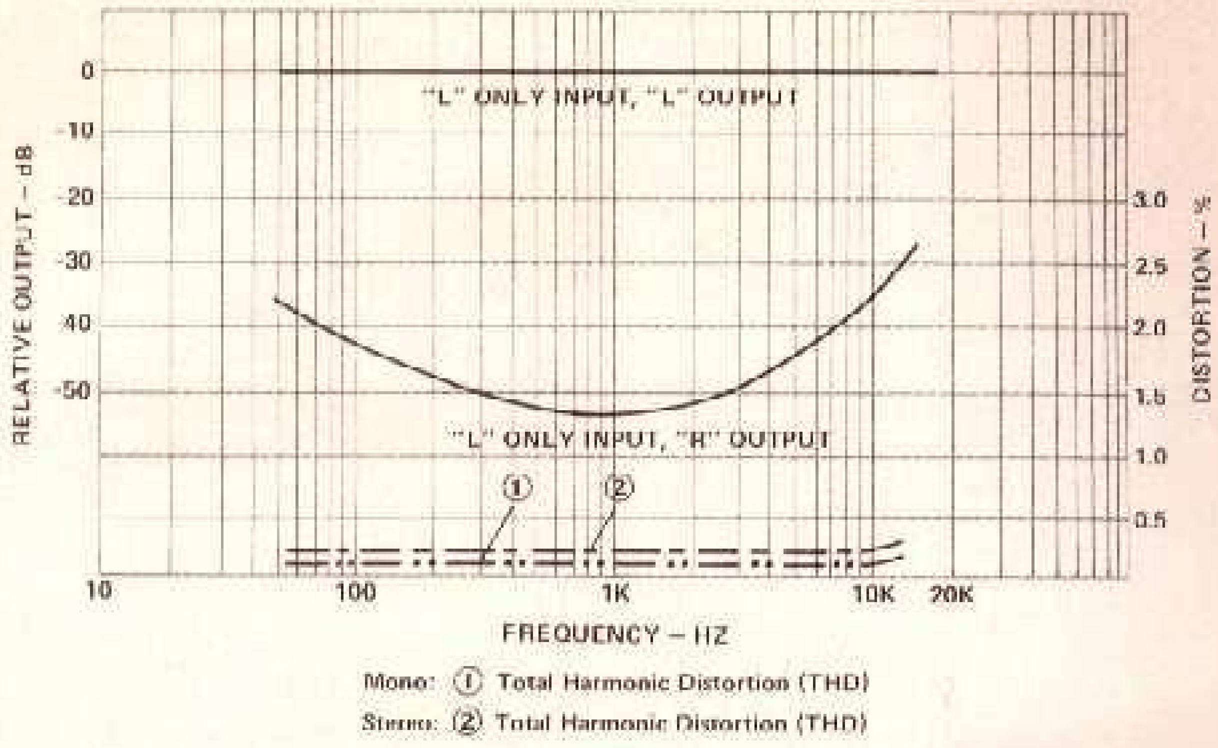


Fig. 8 – Separtion and distortion versus frequency (with selectivity switch set to "NORMAL")

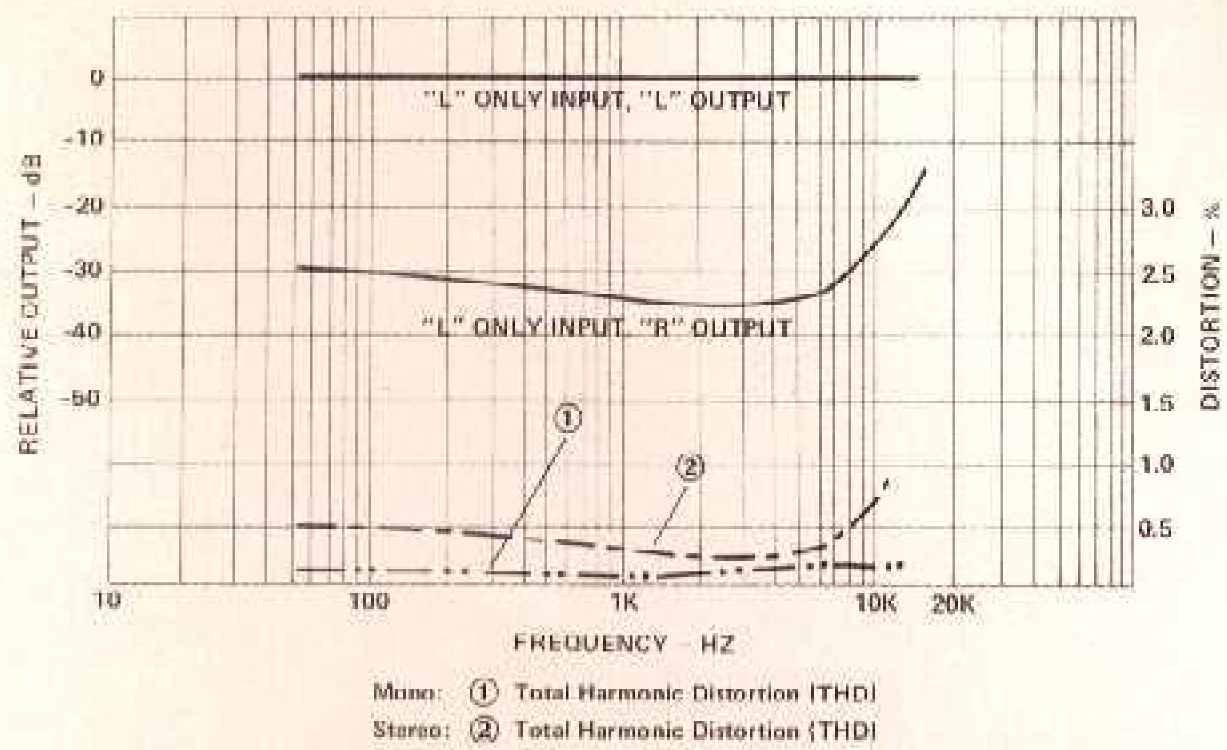


Fig. 9 – Separation and distortion versus frequency (with selectivity switch set to "NARROW")

Previously, we had measured signal voltages of 2 to 3 volts at that location and found that most tuners did exhibit cross-modulation and other overload effects. With the "Mac" tuner, we were able to clearly separate closely spaced high-signal stations on the dial with nary a trace of interference from other strong-signal stations in the same vicinity.

Other Use and Listening Tests

Back in our lab (some 20 miles from the city), we began to appreciate the importance of that selectivity switch on the front panel. If you are an inveterate FM DX-er, you will be amazed (as we were) at how many signals you can separate and receive clearly by using the narrow (and at times even the super-narrow) selectivity switch positions on the MR 78. Here is a tuner that doesn't compromise between low distortion and wide bandwidth. 55 dB of selectivity (that claimed in the NORMAL setting) is no problem if you are not plagued by adjacent and alternate channel signals. In fact, the normal setting, coupled with those linear phase filters in the IF section, rendered the kind of reception from the few good quality stations that we have in our listening area that we had often dreamed about. Program quality varied, of course, but when we were fortunate enough to tune to a live concert (yes, we still do have some live FM programming in this area, albeit at midnight each night), the results were truly astounding. We had the feeling that the late Major Armstrong, too, would have smiled if he could have heard FM the way we heard it over the Mac MR 78.

There was only one instance where we found it necessary to use the SUPER-NARROW position of the selector switch, and that was when we were trying to listen to a weak signal originating some 120 miles from our listening location – one nestled between a stronger signal 200 kHz below it, and a much stronger local station, 200 kHz on the higher side of the dial. If you've ever tried to receive that kind of signal on a lesser tuner, you'll know what we mean. In any case, when we did switch to the SUPER-NARROW position, we actually were able to listen to the desired distant station and distortion, though audibly higher, was still at tolerable levels.

Naturally, one would think twice before spending close to $900.00 for an FM tuner, but if you are confronted with the same sorts of signal conditions as exist in our test location and have been repeatedly frustrated in your attempts to zero in on desired stations, only to be annoyed by rasps, buzzes and spiked sounds "spilling in" as interference, the McIntosh MR 78, with its three positions of selectivity, may well be one of the only, if not the only high quality tuner that will do the job.

Electronic Laboratories'

PRODUCT ANALYSIS

THE McINTOSH MR78 FM/FM STEREO TUNER

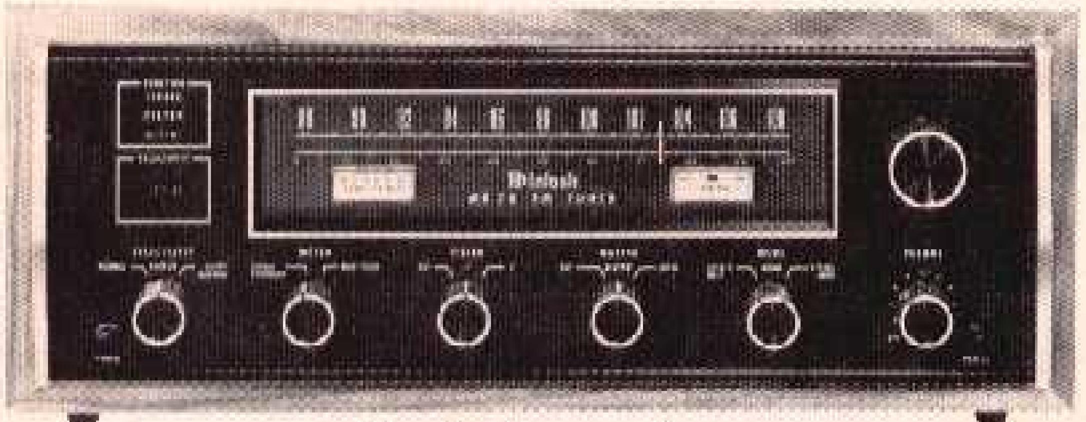


Fig. 1 — Front view

MANUFACTURER'S PUBLISHED PERFORMANCE LIMITS (SPECIFICATIONS):

Tuning Range: 88 to 108 MHz. **Antenna Inputs:** 300 ohms balanced; 75 ohms unbalanced. **Intermediate Frequency (IF):** 10.7 MHz **Sensitivity:** 2 μV for 35 dB of quieting; 2.5 μV at 100% modulation ($\pm$ 75 kHz deviation) for 3% total noise and harmonic distortion. **Signal to Noise Ratio:** 75 dB below 100% modulation. **Harmonic Distortion:** 0.2% 20 Hz to 15,000 Hz, mono or stereo at 100% modulation. Typically, 0.05% at 1000 Hz. **Drift:** 25,000 Hz for the first two minutes; thereafter 5,000 Hz at 25° C in 24 hours. **Frequency Response:** MONO $\pm$ 1 dB 20 Hz to 20,000 Hz with standard deemphasis, (75 μS). STEREO $\pm$1 dB 20 Hz to 15,000 Hz with standard deemphasis, (75 μ S). **Capture Ratio:** 0.25 dB detector only; 2.5 dB complete tuner. **Selectivity (IHF):** Adjacent Channel: set switch to: normal, 7 dB; narrow, 22 dB; super narrow, 55 dB. Alternate Channel: set switch to: normal, 55 dB; narrow, 90 dB; super narrow, 90 dB; super narrow, 90 dB. **Spurious Rejection:** 100 dB IHF. **Image Rejection:** 100 dB, 88 to 100 MHz, (IHF). **Intermodulation Distortion:** 0.2% mono or stereo for any combination of frequencies from 20 Hz to 15,000 Hz with peak modulation equal to 100% or less. Typically 0.1%. **Maximum Signal Input:** 12 volts across 300 ohms antenna terminals will not increase harmonic or intermodulation distortion. **Audio Hum:** 75 dB down from 100% modulation. **Muting:** 70 dB noise reduction between stations. **Muting Threshold:** (Typical): Distant position 5 μV; Local position 20 μV. **SCA Filter:** 50 dB down from 67 kHz to 74 kHz; 275 dB per octave slope. **Stereo Separation:** 40 dB at 1,000 Hz. **Stereo Filter:** (Typical): 10 dB noise reduction in Position 1; 20 dB noise reduction in Position 2. **Audio Output:** Front panel controlled: 2.5 volts into 47,000 ohms. Fixed output: 2.5 volts into 47,000 ohms; 1.0 volt into 600 ohms. (All tuner performance limits were measured with SELECTIVITY switch set at NORMAL, unless otherwise stated.)

GENERAL SPECIFICATIONS:

Power Requirements: 120 volts, 50/60 Hz, 35 watts. **Semiconductor Complement:** 3 J FET's, 2 MOS FET's, 17 Bipolar Transistors, 43 Diodes, 4 Integrated Circuits.

MECHANICAL SPECIFICATIONS:

Size: Front Panel: 16 inches wide (40.64 cm) by 5-7/16 inches high (13.81 cm); Chassis: 15 inches wide (38.1 cm) by 13 inches deep (33.02 cm), including PANLOC shelf and back panel connectors; Knob clearance 1-1/2 inches (3.81 cm) in front of mounting panel. **Weight:** 27 pounds (12.25 kg) net, 39 pounds (17.69 kg) in shipping carton. **Finish:** Front panel; Anodized gold and black with special gold/teal panel nomenclature illumination; Chassis: Chrome and black. **Mounting:** McIntosh developed professional PANLOC.

Most of the semi-technical literature intended for audiophile-consumer education deals with the specifications of an FM or a stereo FM tuner as though each were mutually independent of the others. For example, we are at once told that "good selectivity" (the ability to tune to stations closely spaced in frequency without encountering interference from nearby stations on the dial) and wide bandwidth as well as low distortion are mutually exclusive parameters. We are also led to believe that a tuner "should have ultra low harmonic or intermodulation distortion", but we are hardly ever told that such low distortion can only be achieved if the IF bandwidth of the tuner is sufficiently broad (and linear in phase) to accommodate the upper modulation sidebands of the incoming signal which may well extend well beyond the nominal 150 kHz which is supposed to represent the "maximum bandwidth" of a given FM channel. But if bandwidth is broadened to accommodate such extreme sidebands (which occur particularly during stereo FM transmissions), how is it possible to achieve high orders adjacent channel (or even alternate channel) selectivity? Excellent stereo separation at high audio frequencies is also dependent upon adequate bandwidth, so that again, such high orders of separation are in conflict with high orders of selectivity. What's to be done? Most tuner manufacturer's content themselves with a series of trade-offs. Selectivity figures are made high enough (without sacrificing low distortion and good separation) so that in **most** listening areas adjacent-channel or co-channel interference will not pose much of a problem **most** of the time. McIntosh has attacked the problem in a more logical and direct method — by providing variable selectivity on their MR 78 tuner. But more of this shortly.

The front panel of the McIntosh MR 78 maintains the traditional "Mac" look of "black glass" and features that company's well known PANLOC mounting method (shelves and shelf mounting brackets, together with necessary mounting hardware are, as usual, supplied) as pictured in Fig. 1. The large, illuminated dial area at the upper center of the panel has a linear dial scale, calibrated at every half MHz, as well as a 0-100 logging scale for easy referencing of favorite stations. The smooth traveling dial pointer is

Printed With The Permission Of Electronic Laboratories variable output jacks. The power supply section consists of a 24-volt regulated supply which uses electronic filtering and supplies power to all signal stages, while a second, half wave rectifier supply also equipped with electronic filter circuits feeds the necessary DC voltages to the multiplex decoder section.

Laboratory Measurements

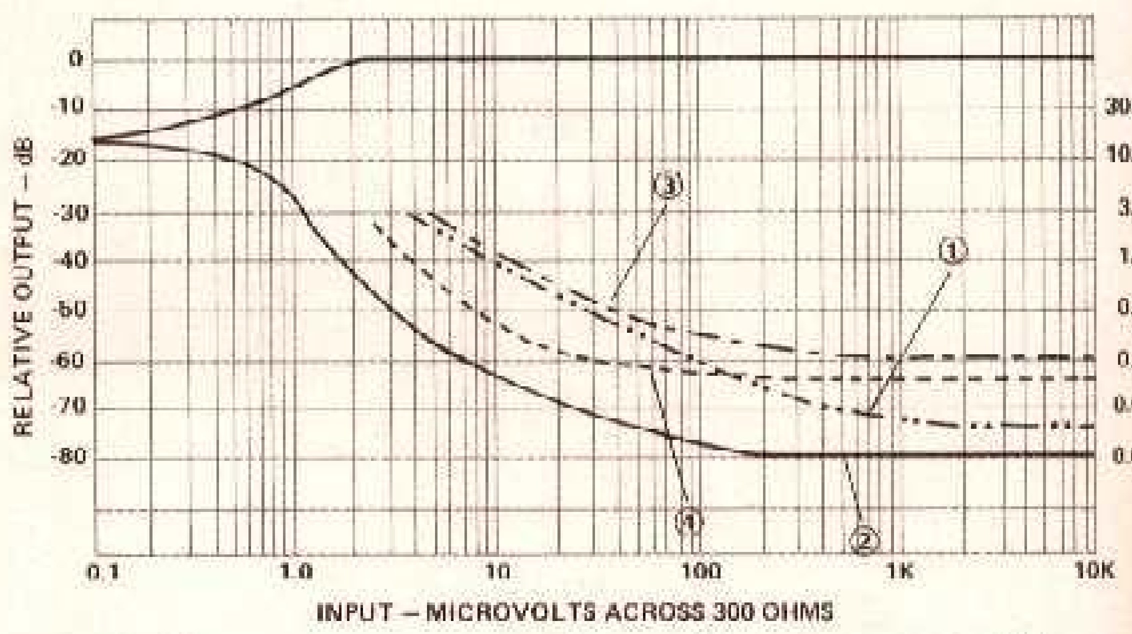
Although most listening situations require selectivity settings of NORMAL on the MR 78, we decided to measure performance in this setting as well as the NARROW selectivity setting. In the NORMAL setting, IHF sensitivity measured 2.0 μV (11.2 dBf) and 50 dB quieting was reached with an input signal strength of 3.0 μV (14.7 dBf) in mono. Referring back to the published specifications, readers will note that McIntosh has not as yet seen fit to bring their specs into line with the newly adopted IHF/IEEE/EIA FM Tuner Measurement standards. Thus, no claim is made for the 50 dB quieting sensitivity, for example, and Mac offers us a 35 dB quieting point instead. While we recognize that McIntosh has, in the past, differed with the rest of the industry in the matter of publishing specifications, we do feel that the new tuner standards are worth following and would hope that if they have not already done so, McIntosh would bring their published specs into line so that they might be easily compared with those of other companies. Be that as it may, 3.0 μV (14.7 dBf) is a very respectable figure for 50 dB quieting. Stereo sensitivity was 4.5 μV (18.3 dBf), at which signal strength in stereo was sufficient to cause nearly 35 dB of quieting. 50 dB of quieting in stereo was attained with an input signal of 32 μV (35.3 dBf). Ultimate S/N in mono was an incredibly high 81 dB (we never thought our signal generator could read that low – now we know it can), while in stereo, best quieting for strong signals was 73 dB. Total harmonic distortion in mono was a low 0.06%, while in stereo, for the same strong signals used, THD read 0.1% at 1kHz. Curves of results obtained in the Normal selectivity setting are plotted in Fig. 6.

Switching to the NARROW selectivity setting, S/N readings in both mono and stereo remained virtually the same, but, as was to be expected, THD readings increased slightly, to 0.08% for mono and 0.35% for stereo. These results are shown in Fig. 7.

Returning to the NORMAL selectivity setting, we measured a capture ratio of 1.8 dB. Alternate channel selectivity was 57 dB for this setting, while image and spurious rejection were both in excess of 100 dB (the limits of our test equipment). Maximum deviation from ideally flat frequency response, for both mono and stereo, was less than 1.0 dB, with the deviation approaching that number at 15 kHz but remaining within 0.2 dB at frequencies from 10 kHz down to 50 Hz. Muting threshold occurred at 7.0 μV for the "distant" position, 30 μV for the "local" position. Stereo switching occurred at around 4.0 μV (17.2 dBf).

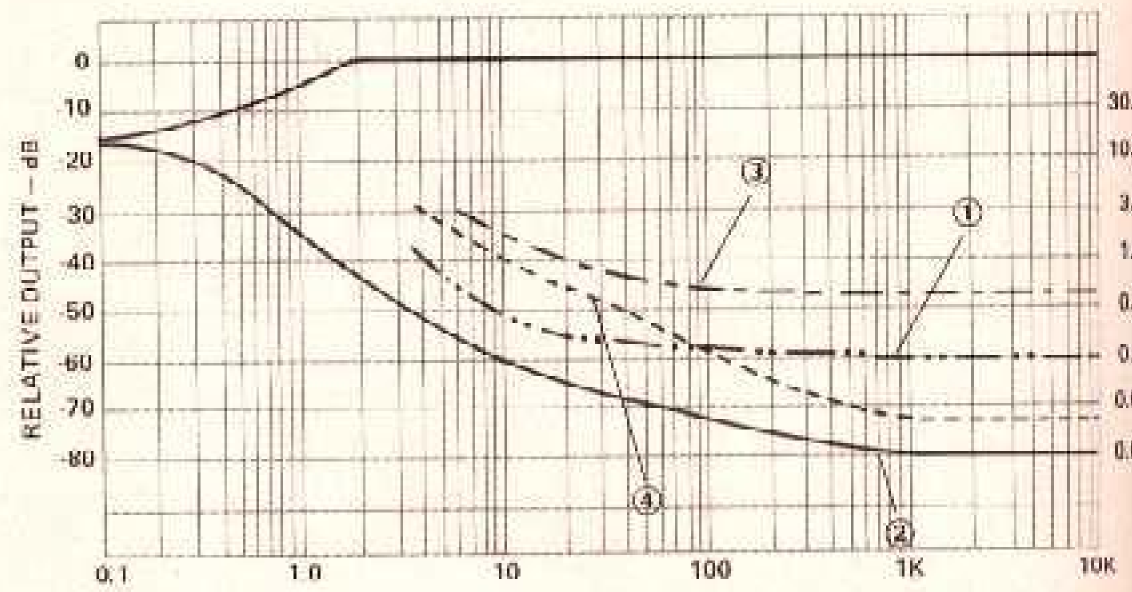
Stereo separation measured 52 dB at mid frequencies for the normal selectivity position, decreasing to 43 dB at 100 Hz and 36 dB at 10 kHz, as plotted in Fig. 8. In order to properly ascertain the THD produced by the tuner at high modulating frequencies it was necessary for us to employ our spectrum analyzer and to "sum" the harmonic products mathematically to arrive at the 0.14% THD figure shown for a 10 kHz modulating frequency. If this is not done, super-audible products (not properly identifiable as harmonic distortion) "cloud" the single-reading measurement that is obtained on a conventional meter-type distortion analyzer.

Fig. 9 is a plot of separation versus frequency with the selectivity control set to the NARROW position. Separation naturally suffers somewhat when this narrow setting is used, but remains well above 30 dB for most frequencies tested. Distortion in stereo also rose somewhat in the narrow setting, as shown in the curves of Fig. 9. While in mono, THD remained incredibly low at mid-frequencies even when the narrow setting of the selectivity switch was used. Sub-carrier product rejection was so good that it was not even necessary to use the recommened 15 kHz low-pass filters for all of our high-frequency noise and distortion measurements, except as already noted for the 10 kHz readings. Audio output level was exactly 2.5 volts, as claimed, for a 100% modulation signal at the fixed output terminals. Since our own signal generating equipment is limited to 0.2 volts output, there was no way for us to verify McIntosh claims regarding 12 volt antenna input overload capability, though we have no reason to doubt the claim, based on subsequent strong-signal listening tests. We purposely carted the tuner over to a mid-city location where we have access to a listening room that is just a few blocks away from several high-powered FM transmitters.



Mono: ① Total Harmonic Distortion (THD) ② Signal To Noise Ratio (S/N)
Stereo: ③ Total Harmonic Distortion (THD) ④ Signal To Noise Ratio (S/N)

Fig. 6 – FM quieting and distortion characteristics (with selectivity switch set to "NORMAL")



Mono: ① Total Harmonic Distortion (THD) ② Signal To Noise Ratio (S/N)
Stereo: ③ Total Harmonic Distortion (THD) ④ Signal To Noise Ratio (S/N)

Fig. 7 – FM quieting and distortion characteristics (with selectivity switch set to "NARROW")