3 PROTON 440 TUNER

Manufacturer's Specifications

FM Tuner Section

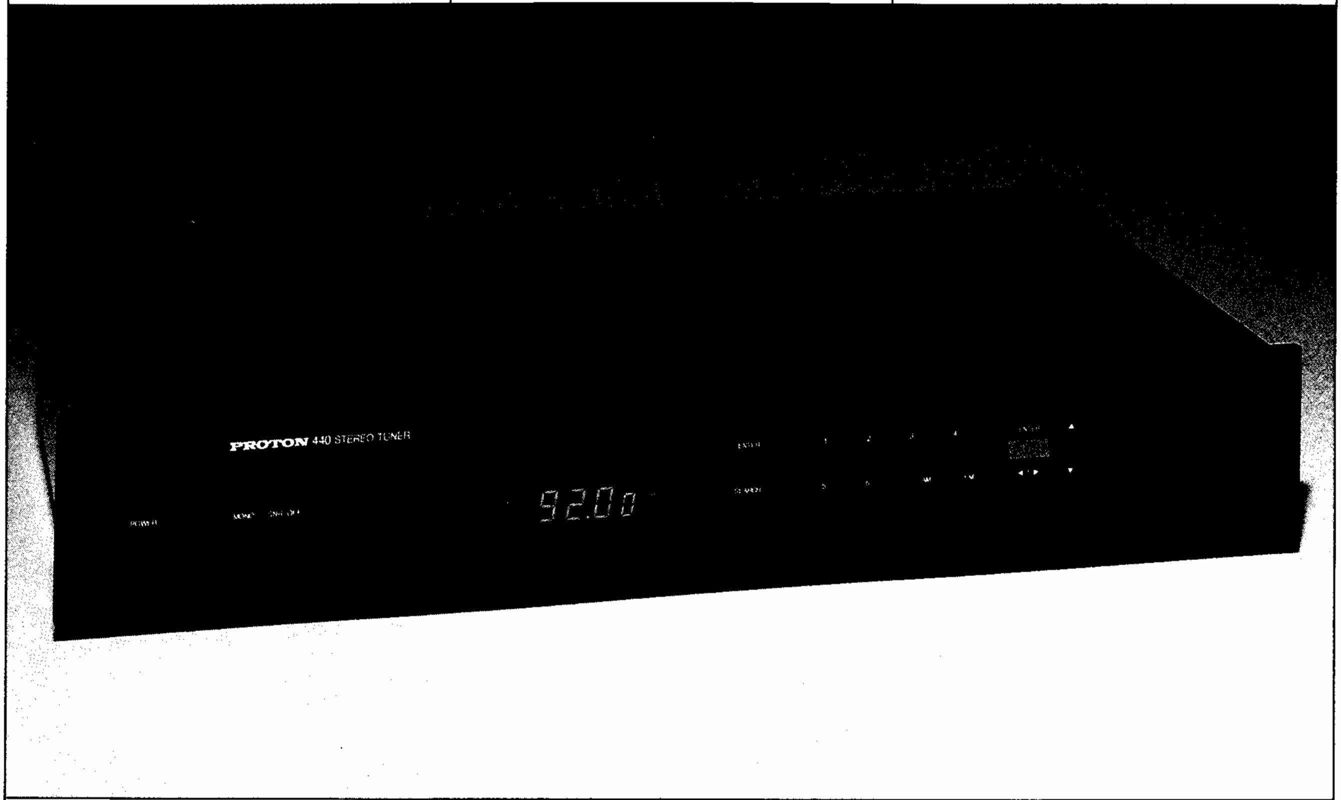
Usable Sensitivity: Mono, 10.3 dBf.
50-dB Quieting Sensitivity: Mono, 15.3 dBf; stereo, 33.2 dBf.
S/N + Hum: Mono, 75 dB; stereo, 70 dB.
THD: 0.2%.
Capture Ratio: 1.5 dB.
AM Rejection: 60 dB.
I.f. Rejection: 90 dB.
Image Rejection: 55 dB.
Stereo Separation: 45 dB at 1 kHz.

AM Tuner Section

Usable Sensitivity: 20 µV.
Selectivity: 35 dB.
S/N: 43 dB.
Image Rejection: 35 dB.
I.f. Rejection: 50 dB.
THD: 0.5%.

General Specifications

Dimensions: 16 in. (40.6 cm) W × 3 in. (7.6 cm) H × 10 in. (25.4 cm) D.
Weight: 15 lbs. (6.8 kg).
Price: $270.
Company Address: 737 West Artesia Blvd., Compton, Cal. 90220.
For literature, circle No. 92



When Larry Schotz designed his noise-reduction circuitry for NAD, they called it Dynamic Separation, but Schotz no longer gives manufacturers exclusive use of his innovative and original circuitry. So now, Proton is using a slightly different version of the same noise-reducing idea, and calling it SNR. As you may have guessed, SNR gives at least abbreviated credit to its inventor; the initials stand for Schotz Noise Reduction. Since the circuitry used in the Proton 440 and the NAD 4155 (reviewed in the December 1984 issue) is *basically* the same (though active devices used in the circuits are different), I won't go into a long description of how SNR works. Instead, here's a brief summary:

The circuitry reduces noise normally heard during weak-signal stereo FM reception by blending the high-frequency content of both channels during quiet moments or pauses in the music. Wider separation at high frequencies is restored when there is more significant high-frequency stereo information in the signal (louder treble content) or when the signal itself is stronger and therefore less noisy to begin with. Unlike ordinary "blend" circuits (which reduce treble separation during weak-signal reception regardless of program content), the SNR circuit works dynamically. It is most effective when signal strength ranges from around 20 dBf (the stereo switching threshold of this tuner) up to about 45

The best the SNR circuit did was to reduce noise by 7 or 8 dB, but that can be enough to turn an unusable signal into a tolerable one.

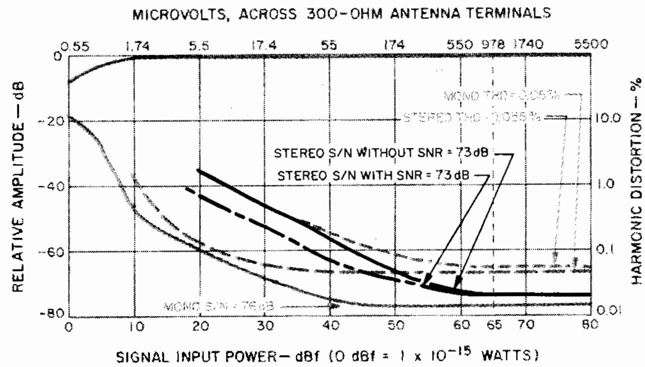


Fig. 1—Mono and stereo quieting and distortion characteristics, FM section.

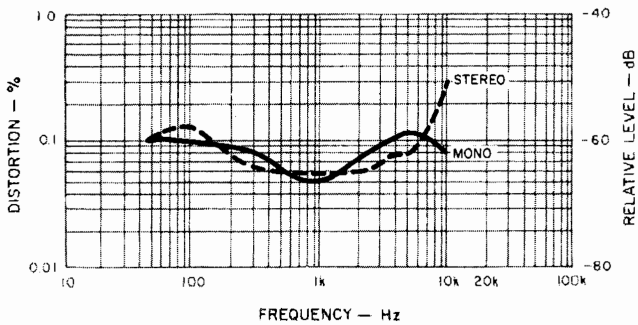


Fig. 2—Harmonic distortion vs. frequency.

or 50 dBf. Beyond that signal strength, the signal-to-noise ratio (about 65 dB at 50 dBf) is high enough so that no further action of the SNR circuitry is necessary.

Control Layout

The simple, all-black front panel of the Proton 440 has its "Power" on/off pushbutton at the extreme left. Nearby are a pushbutton for mono/stereo selection and an "SNR Off" button which deactivates the Schotz Noise Reduction circuit whenever the user deems it necessary. An illuminated numeric display shows the AM or FM frequency to which the tuner has been set; above this display is a five-element LED signal-strength indicator, a "Stereo" indicator light, and a "Locked" indicator which flashes as you approach a correct tuning point and stays continuously lit when correct tuning has been achieved. Two more indicators, to the right of the main display, are identified as "Search" and "Enter." The "Search" LED is illuminated whenever you put the tuner into the search mode, a tuning method which seeks the next usable incoming signal on the FM dial. The "Enter" LED lights when the "Enter" pushbutton is pressed to memorize one of 12 possible station frequencies (six AM and six FM).

The three remaining buttons on the front panel are for the tuning functions. Up and down arrows advance the tuner to the next higher or lower usable signal frequency, either in 200-kHz increments or in the search mode, depending upon whether the "Search" button has been depressed.

On the rear of the Model 440 are spring-loaded, 300-ohm FM, AM and ground terminals which, when depressed, expose tiny holes that grab and retain stripped wire ends. These terminals, similar to speaker terminals found on amplifiers, allow easy connection of stripped wires, but cables terminated in spade lugs are not so easy. Fortunately, the cable for the separate AM loop antenna has stripped and tinned ends for easy insertion. If you use an FM dipole other than the one supplied with the tuner—one that's equipped with spade lugs—you'd be better off removing those spade lugs and stripping and tinning the lead ends before connecting it to the terminals on the back of the 440. There is also a coaxial connector, conventional in design and use, for 75-ohm transmission lines. An output-level control and two output jacks complete the rear-panel layout.

Measurements

Usable sensitivity in mono was extremely good, measuring 9.0 dBf, close to the theoretical limit of sensitivity. Stereo-switching threshold was set at around 23 dBf, at which point noise plus distortion was already −36 dB compared to a reference 100%-modulated audio signal. Figure 1 shows how quieting and distortion vary with input-signal strength. Although THD in the stereo mode remains fairly constant whether or not the SNR circuit is activated, the signal-to-noise ratio does change considerably when SNR is used in the signal-strength region from just above stereo threshold to 50 dBf. For that reason, I plotted two curves for stereo THD (for a 1-kHz modulating signal) in Fig. 1. As you might expect, the lower curve (the one depicting better S/N ratios) is the one obtained with the SNR circuit on. At 30 dBf, for example, stereo S/N measures 45 dB without the SNR circuit, but it improves to 52 dB with the SNR circuitry on.

The best mono signal-to-noise ratio at strong signal levels measured 76 dB, while maximum S/N in stereo was 73 dB. At strong signal levels, the SNR circuit does not cause any further improvement in S/N, as you can see by examining Fig. 1. In mono, 50-dB quieting occurred with only 12.0 dBf of signal input. In stereo, without SNR, 50-dB quieting occurred with a signal input of 35 dBf; with SNR, only 28 dBf of input was required to achieve the same 50 dB of quieting.

Figure 2 shows how harmonic distortion varies with modulating frequency in mono and stereo, using 100%-modulated signals in each case. Mono THD, at 1 kHz, measured only 0.05%, barely increasing (to 0.55%) in stereo.

I have not come across a tuner that is more sensitive than the Proton, and when you consider its low price, that's rather remarkable.

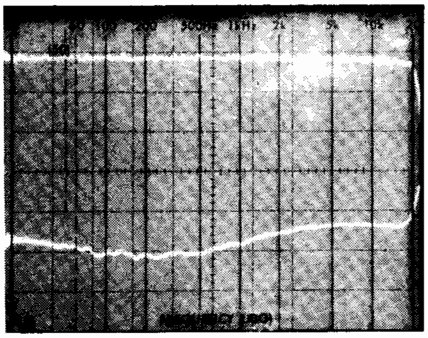


Fig. 3— Frequency response (upper trace) and separation vs. frequency, FM section.

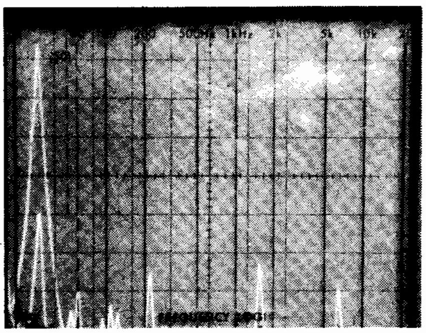


Fig. 4— Analysis of 5-kHz distortion and crosstalk, FM section.

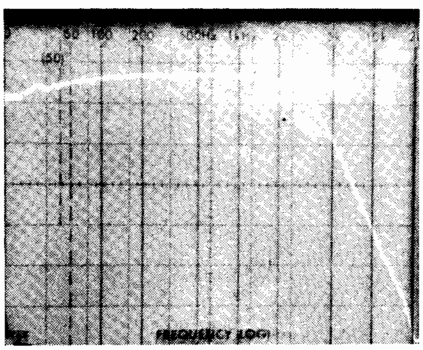


Fig. 5— Frequency response, AM section.

Figure 3 is my familiar 'scope photo showing a logarithmic sweep from 20 Hz to 20 kHz. The upper curve represents frequency response in the stereo mode, and the lower trace shows relative separation (the vertical scale is 10 dB per division). In checking spot frequencies, I measured separation of just under 50 dB at 1 kHz, 43 dB at 100 Hz, and 39 dB at 10 kHz. Essentially the same results were obtained with and without the SNR circuit on, because these measurements were made at a high (65 dBf) signal level.

I attempted a similar sweep at lower signal levels with the SNR circuit turned on, to show how the dynamic blend works, but soon realized that these results would not truly illustrate how the SNR circuit operates. This is because SNR is dynamic; as soon as the sweep would reach high frequencies, what blending there had been a moment earlier would vanish and full separation would be restored. In this case, therefore, you will have to take my word for it; the SNR circuit does work, and it works well. When I listened to musical program material received from fairly distant transmitters, noise was significantly reduced when I activated the SNR circuit; I sensed no apparent loss of stereo separation or stereo imaging.

Figure 4 shows the crosstalk and distortion products appearing at the output of the unmodulated channel when a 5-kHz, 100%-modulated signal was applied to the opposite channel. In this 'scope photo, the sweep is linear (5 kHz per division) and extends from 0 Hz to 50 kHz. Subcarrier product rejection was good—around 65 dB below maximum modulation signals—and SCA rejection was better than 70 dB. Capture ratio measured a bit higher than the 1.5 dB claimed, but AM rejection, i.f. rejection and image rejection were all close to published specifications. Alternate-channel selectivity (not specified by Proton) measured better than 65 dB.

Figure 5 shows frequency response of the AM tuner section. Roll-off began just above 2.5 kHz, and the −6 dB point occurred at around 4.0 kHz. This is slightly better than the average of most AM sets I have measured but is hardly anything to get excited about. Sensitivity and harmonic distortion figures for the AM section conformed closely to published specifications, as did the signal-to-noise ratio.

Use and Listening Tests

If the Proton 440 proves one thing, it is that devotees of FM radio need no longer spend a great deal of money to get very satisfactory FM performance. True, I have measured a few tuners (generally much higher priced) that offer better quieting than the Proton 440, and a few that have somewhat better stereo separation. I have *not* come across a tuner that is more sensitive than the Proton 440, and when you consider its low suggested price, that's rather remarkable in itself.

Larry Schotz's SNR circuit is useful over an important range of signal strengths, as I mentioned earlier. It won't provide any benefits at all if you are lucky enough to live where strong signals are the rule rather than the exception. Nor will it do anything for you if stereo signals are too weak (under 25 dBf or so) to cause the 440 tuner's stereo-decoding circuitry to switch in. Even when it does work, don't expect it to take a noisy signal and render it noise-free. The best the SNR did at any signal level was to reduce noise by about 7 or 8 dB without audibly degrading stereo effects. Under many circumstances, this improvement can turn an unusable signal into a tolerable one. As for standard features that most people want, such as preselection of favorite stations, ease of tuning, search tuning and the like, the Proton 440 has them; they all work well and are easy to use. If you have FM stations worth listening to in your area but find that some of them don't offer quite enough "quieting," even with an outdoor antenna in your listening location, the low-cost Proton 440 may well be worth a look—and a listen.

Leonard Feldman