Equipment profiles

Pioneer TX-9500-II AM/FM Stereo Tuner

MANUFACTURER'S SPECIFICATIONS

FM Tuner Section
Usable Sensitivity, Mono: 8.8 dBf, 1.5 μV.
50-dB Quieting Sensitivity: Mono, 13.2 dBf, 2.5 μV; Stereo, 36.1 dBf, 35 μV.
S/N: Mono, 82 dB; Stereo, 77 dB.
Frequency Response: 20 Hz to 15 kHz, +0.2, −0.5 dB.
AM Supression: 65 dB.
Image Rejection: 120 dB.
I.F. Rejection: 105 dB.
Spurious Rejection: 110 dB.
Muting Threshold: 19.2 dBf (5 μV)/ 34.1 dBf (28 μV).
Subcarrier Rejection: 77 dB.
SCA Rejection: 62 dB.
THD in Wide I.F. Position: Mono, 0.07 per cent @ 100 Hz, 0.05 per cent @ 1 kHz, 0.07 per cent @ 10 kHz; Stereo, 0.1 per cent @ 100 Hz, 0.07 per cent @ 1 kHz, 0.2 per cent @ 10 kHz.
THD in Narrow I.F. Position: Mono, 0.07 per cent @ 100 Hz, 0.07 per cent @ 1 kHz, 0.1 per cent @ 10 kHz; Stereo, 0.3 per cent @ 100 Hz, 0.25 per cent @ 1 kHz, 0.5 per cent @ 10 kHz.
Capture Ratio: Wide, 0.8 dB; Narrow, 2.0 dB.
Selectivity: Wide, 35 dB; Narrow, 85 dB.
Stereo Separation: Wide, 35 dB @ 100 & 10,000 Hz, 50 dB @ 1 kHz; Narrow, 30 dB @ 100 & 10,000 Hz, 45 dB @ 1 kHz.

AM Tuner Section
Sensitivity: Ext. Ant., 15 μV.
Selectivity: 30 dB.
S/N: 55 dB.
Image Rejection: 70 dB.
I.F. Rejection: 65 dB.

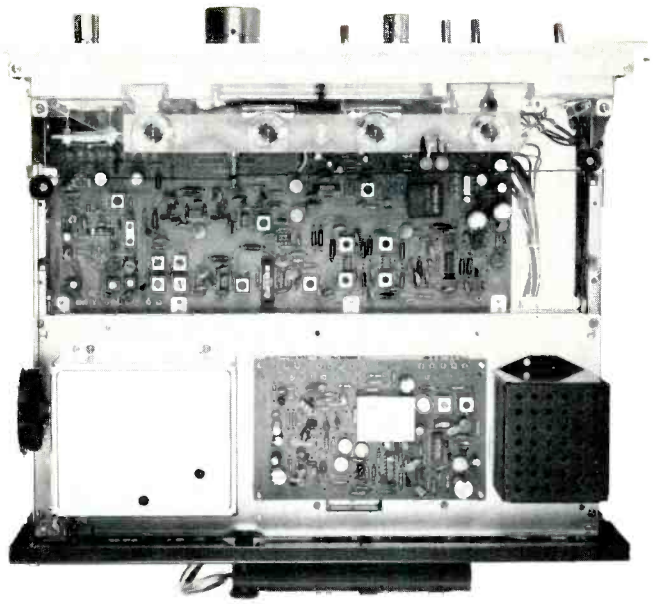
General Specifications
Audio Output Level: FM, 100 per cent modulation, 650 mV fixed or 50 mV to 1.3 V variable; AM, 30 per cent modulation, 200 mV fixed or 15 mV to 400 mV variable.
Power Requirements: 120 V, 60 Hz, 25 watts.
Dimensions: 16 9/16 in. (42 cm) W x 5 7/8 in. (15 cm) H x 15 9/16 in. (39.5 cm) D.
Weight: 20 lbs. 15 oz. (9.5 kg).
Price: $400.00.

U.S. Pioneer Electronics has now joined that distinguished group of FM tuner designers who realize that the world (and, in particular, the world of FM) is full of compromises. If one wants super selectivity in an FM tuner, one must sacrifice super-low distortion and super-high stereo separation. But not everyone wants or needs such high levels of selectivity (some areas of the country have few FM stations spread across the band from 88 to 108 MHz, while others, though crowded over certain portions of the dial, have "open frequency space" at other portions of the dial).

To provide the "best of both worlds," Pioneer has now come up with selectable i.f. bandwidth—a feature which has been available on such high-end tuners as those made by Yamaha, Sansui, and, of course, McIntosh for some years now. But, when one takes a look at the price of this tuner, the accomplishment is all the more remarkable.

The front panel of the TX-9500-II follows the styling adopted by Pioneer in all its recent components. It is all gold-colored, including the highly visible dial area which slopes back for easy viewing. Signal-strength and center-of-channel meters are prominently positioned at mid-scale, above the linearly calibrated FM frequency and AM frequency dial scales. A rectangle of light to the right of the meters tells us when a stereo signal is received, while two rectangles at the left denote the *wide* or *narrow* settings of the i.f. bandwidth switch located at the lower left of the panel. Four movable "markers" or "sliders" glide along the lower edge of the dial opening and can be manually positioned for designating most often tuned-to frequencies. Pioneer calls this added feature its "memory markers."

Controls along the lower section of the panel include a toggle-type power switch, the aforementioned wide narrow i.f. switch, a three-position switch which provides an audible check of multipath distortion (one listens for a *minimum* of sound while orienting the antenna when the switch is set for multipath checking), as well as a 440-Hz calibrating tone corresponding to 50 per cent of full modulation and useful for pre-setting record level controls when recording an FM program. A rotary output-level control and a three-position muting control (*Off* and two threshold levels) come next, followed by the large diameter tuning knob, and a function selector switch with positions for AM, FM, FM with noise-filtering, and FM-mono. The "noise filter"



position is intended for use with weak-signal stereo stations and reduces high frequency stereo separation but does not alter overall frequency response.

The rear panel of the TX-9500-II is equipped with the usual external AM, ground, 300- and 75-ohm antenna terminals. A suitable clamp arrangement retains the coaxial cable in place if that type of lead-in transmission line is used. A slide switch, permanently "locked" in its 75 microsecond position, may be moved to the alternate 25-microsecond de-emphasis position by removing a retaining bracket if a Dolby decoder is to be used in conjunction with the tuner for proper reception of Dolby FM programs. Horizontal and vertical output jacks for connection to an oscilloscope for visual multipath observation are located near the center of the rear panel, the former also useful as an FM detector output jack for future discrete four-channel adaptor connection. Pairs of fixed level and variable output jacks come next, along with a single unswitched a.c. convenience receptacle. A pivotable ferrite bar which swings away from the rear panel serves as the built-in AM antenna.

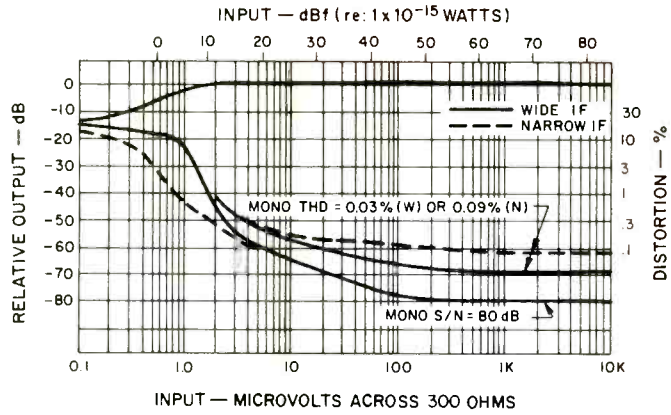


Fig. 1—FM quieting and distortion characteristics in mono.

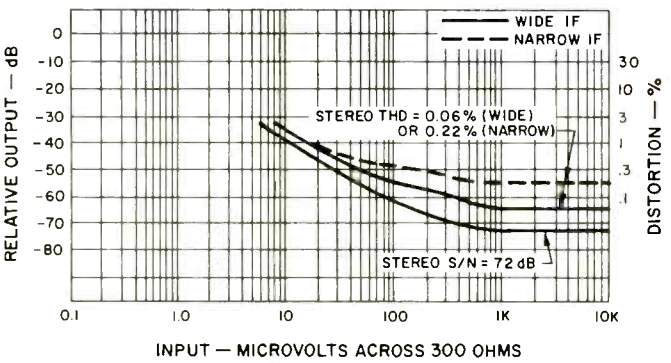


Fig. 2—FM quieting and distortion characteristics in stereo.

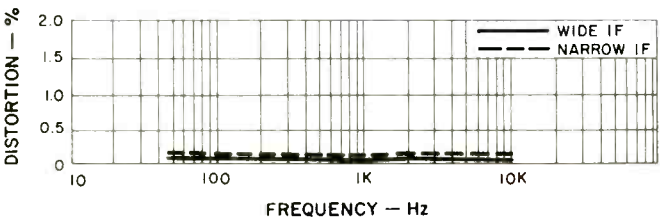


Fig. 3—Distortion vs. frequency for the Pioneer TX-9500-II in mono operation.

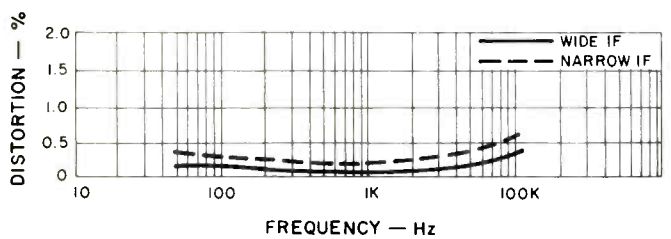


Fig. 4—Distortion vs. frequency in stereo.

Circuit Description

The front end of the TX-9500-II includes a five-gang tuning capacitor, two dual-gate MOS-FETs as r.f. amplifiers, a third MOS-FET for the mixer stage, and a buffer stage following the local oscillator. A three-gang tuning capacitor is used in conjunction with a multi-purpose IC for AM reception. There are actually two complete i.f. systems in the tuner, one a wide-band i.f. system which utilizes, among other things, a newly developed "surface acoustic wave" filter plus a four-pole phase-linear filter; the other for narrow-band reception which utilizes a 10-element ceramic filter to obtain the desired high level of alternate channel selectivity. When switching from one mode to the other, completely different i.f. signal chains are activated, unlike other designs having selectable bandwidth in which one or two circuit elements are switched to achieve the various bandwidth modes.

A new phase-lock-loop multiplex circuit includes an automatic pilot-carrier-cancelling circuit which permits extended flat frequency response in stereo FM without having to settle for a high level of carrier leakage at the output. A separate audio and MPX muting assembly contains three special purpose ICs, one of which takes care of the required audio amplification and isolation and employs full negative feedback in a differential direct-coupled audio frequency circuit. Total semi-conductor complement of this tuner consists of five FETs, 15 ICs, 12 transistors, and 19 diodes. The power-supply circuit board delivers two fully regulated voltages for operation of critical FM and AM circuits.

FM Laboratory Measurements

Measuring the FM performance of the TX-9500-II was like measuring two separate tuners, for each of the many measurements taken had to be repeated for the wide and narrow bandwidth settings. Figure 1 is a plot of signal-to-noise and distortion characteristics in both modes, with the tuner in the mono mode. While ultimate signal-to-noise ratio for strong (65 dBf) signals was the same for both bandwidth modes (80 dB—probably the limit of our test equipment), at very low input signal levels, the narrow mode offers somewhat steeper quieting, reaching the 50-dB quieting point with an input signal level of 2.0 μV (11.2 dBf) as opposed to 2.2 μV (12.0 dBf) in the wide mode. Differences in distortion are also apparent, with best readings of 0.03 per cent (yes, we said 0.03 per cent!) in the wide mode and perfectly acceptable levels of 0.06 per cent for the narrow mode. On the basis of these mono results, one might be tempted to ask why Pioneer bothered with the wide mode at all here (since good selectivity, measured at 86 dB for the narrow mode, as against 35 dB for the wide position, is never a fault if it can be had without sacrificing low distortion and good S/N ratios)—until one examines stereo performance relative to these same parameters, as plotted in Fig. 2. Here we see that while the wide position still yields amazingly good, low distortion of 0.06 per cent at 1 kHz (about the lowest we have ever read for any tuner operating in stereo), when it becomes necessary to switch to the narrow position for improved selectivity, distortion in stereo increases to around 0.22 per cent under the same test conditions. In mono operation, distortion at other frequencies (plotted in Fig. 3) is almost identical regardless of the i.f. bandwidth mode selected but, in stereo (see Fig. 4), the differences are once again fairly significant.

In stereo operation, usable sensitivity measured 6.0 μV (20.8 dBf) regardless of the bandwidth mode chosen (it measured exactly 1.5 μV, or 8.7 dBf, for mono), and there was only a slight difference in the 50-dB quieting sensitivity (32

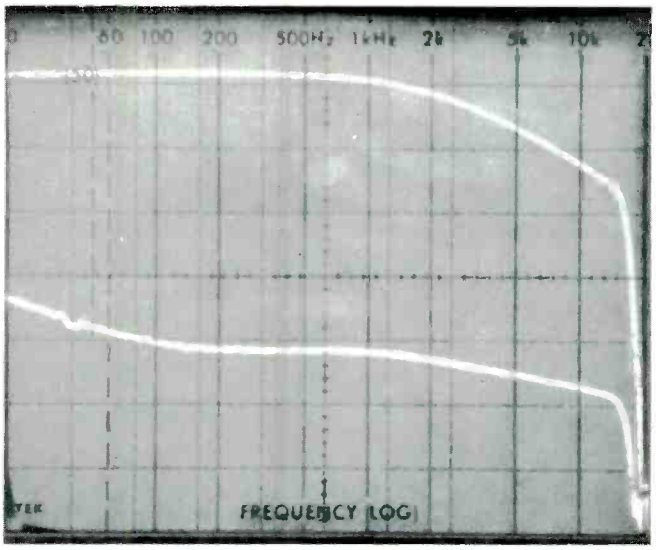


Fig. 5—Stereo separation for the Pioneer TX-9500-II in the wide i.f. setting.

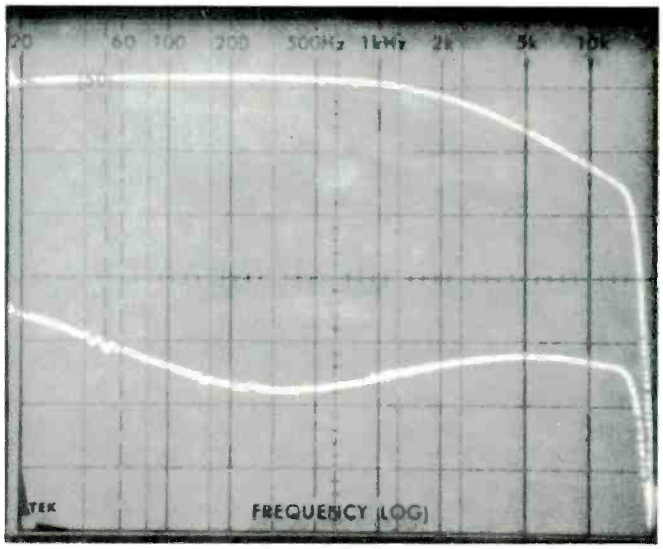


Fig. 6—Stereo separation in the narrow i.f. setting.

μV or 35.3 dBf for the wide mode, slightly better at 30 μV or 34.7 dBf in the narrow mode).

Differences showed up in stereo separation capabilities between the two modes of operation as well. We have devised a real-time method of plotting separation on our spectrum analyzer which will be used in this and all future test reports and which, we feel, accomplishes more than just a graphic display of separation capabilities. With the tuner set to the "wide" mode, the upper trace of Fig. 5 depicts the desired channel output of the tuner while the lower trace shows output from the opposite channel. The plot extends logarithmically from 20 Hz to 20 kHz. The decreasing output above about 500 Hz clearly shows the de-emphasis characteristic, which is down the requisite 13.6 dB at 10 kHz (each vertical division equals 10 dB in this display), and, in addition, we can clearly see the extremely effective 19 kHz cancellation circuit action as the output takes a steep dip at that undesired frequency. Actual metered measurements showed a maximum separation of nearly 50 dB at mid frequencies, decreasing to 40 dB at 50 Hz, and to 38 dB at 10 kHz.

Spectrum analyzer plots were repeated with the switch set to the narrow position, and results are shown in the 'scope photo of Fig. 6. The somewhat "degrading" effect of the narrower i.f. bandwidth shows up clearly as a diminution of high-frequency stereo separation which measured 32 dB at 10 kHz. Separation at mid-frequencies was still a superb 45 dB, while at 50 Hz, separation now read 38 dB, a slight decrease over that observed in the "wide" position.

Various rejection capabilities measured in excess of 100 dB (the limits of our test equipment), while capture ratio in the wide position measured a shade under 1.0 dB and increased to 2.0 dB for the narrow setting. AM suppression measured 65 dB as claimed, while sub-carrier rejection was so good as to be buried below the noise threshold. Frequency response was better than claimed, within 0.4 dB of the prescribed de-emphasis curve at 15 kHz in the wide mode, but down 1.0 dB in the narrow mode. Muting threshold was measured at 4.0 μV (17.2 dBf) or 30 μV (34.7 dBf), depending upon the setting of the dual-position front-panel muting switch, while stereo threshold or switching occurred at 6.0 μV (20.8 dBf). We did note that, based upon our measurements, the 440-Hz calibration tone corresponded more nearly to 100 per cent modulation than to 50 per cent modulation.

As for the AM section, it is a cut above most AM tuners supplied on high fidelity components these days. Sensitivity measured 15 μV as claimed, while signal-to-noise ratio (for a 1 mV input) reached 56 dB. Distortion, for 30 per cent modulation, was 0.7 per cent, and selectivity measured 32 dB. Other listed specifications were confirmed exactly. Calibration, for both AM and FM, was very precise from one end of the dial to the other, and center-of-channel meter indications corresponded very closely with minimum-distortion tuning points in FM.

Summary—Listening and Use Tests

Fortunately, we now have at least two high-quality FM signals in our New York area, and this gave us an opportunity to compare results using both bandwidth positions of this tuner. Yes, we could certainly detect a difference, with reception noticeably cleaner and crisper (in stereo) when using the wide setting. Sure enough, though, when we cruised through the frequency range from around 97.0 MHz to 100 mHz (where our dial is swarming with signals), we found it necessary to switch to the "narrow" position to avoid adjacent channel interference problems. It was as though this feature had been specifically included for our listening area and situation. Listeners in less crowded areas will, no doubt, favor the wide position for most of their listening.

If you do audition this tuner and find that you can't tell the difference between the two settings, chances are the quality of reception is being limited by the broadcaster rather than by the tuner. In short, while we feel that the "wide" position could have been made just a little less wide so that it could be used by more people more of the time (after all, a THD of 0.04 per cent or 0.05 per cent for all practical purposes would have been "just as good" as the fantastic 0.03 per cent we measured), we *certainly* agree that this is the way a top quality tuner should be designed. It does, indeed, offer the "best of all possible" FM worlds, regardless of your particular area and signal conditions. At its relatively low price, it is bound to prove a favorite with those who take their FM listening seriously. *Leonard Feldman*