

# Equipment Profiles

## Marantz Model 4400 Stereo/4-Channel Receiver



### MANUFACTURER'S SPECIFICATIONS TUNER SECTION

R.F. Input for 30 dB Quieting: 1.8  $\mu$ V. Quieting at 50  $\mu$ V (S/N): 70 dB. THD: Mono, 0.2%; Stereo, 0.3%. Selectivity: 75 dB. Capture Ratio: 1.5 dB. Spurious Rejection: 95 dB. Image Rejection: 90 dB. I.F. Rejection: 100 dB. AM Suppression: 60 dB. Stereo Separation, 1 kHz: 42 dB. AM Sensitivity: 20  $\mu$ V (external antenna).

### AMPLIFIER SECTION

Continuous Power output, 8 ohm Loads, All channels Driven: 125 watts x 2; 50 watts x 4 (any frequency from 20 Hz to 20 kHz). Rated THD: 0.15%. Rated IM Distortion: 0.15%. Power Bandwidth: 7 Hz to 70 kHz. Damping Factor: 50 (at 8 ohms). Frequency Response (High Level Inputs): 20 Hz to 20 kHz  $\pm$ 0.25 dB. Input Sensitivity: Phono, 2.0 mV. Equivalent noise input (phono): 1.5  $\mu$ V. High Level Input Sensitivity: 150 mV. Tone Control Range: Bass,  $\pm$ 10 dB at 50 Hz; Treble,  $\pm$ 10 dB at 15 kHz; Mid-Range,  $\pm$ 6 dB at 700 Hz.

### GENERAL SPECIFICATIONS

Power Requirements: 120 V a.c., 50 to 60 Hz. Power Consumption: 650 watts at full power, 60 watts at no signal. Dimensions: 19-19/64 in. W x 5-3/4 in. H x 15-3/16 in. D. Weight: 52.8 lbs. Price: \$1250; SQA-1, \$49.95; SQA-2, \$79.95; CD-400, \$99.95.

To begin with, the Marantz 4400 is *big*. It has to be to incorporate all the features built into it. Examining the front panel, we see a family resemblance to other top-of-the-line Marantz receivers. Large, thumbwheel-edge tuning knob at the right, multi-purpose oscilloscope display at the left—these are all Marantz “originals.” Along the bottom section of the gold and black front panel are a pair of front and rear head-

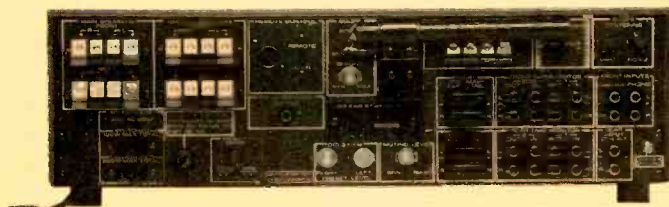


Fig. 1—View of the rear panel.

phone jacks, a Dolby selector switch (with positions for FM DOLBY decoding, PLAY, OFF, and RECORD I and II), program selector switch, three-position tape monitor switch, mode switch (with positions for MONO, TWO-CHANNEL, DISCRETE four-channel, VARI-MATRIX, and SQ DECODER—if the optional module is installed). An adjacent “dimension” control alters the built-in simple matrix parameters to create varying four-channel effects with stereo or matrixed four-channel recordings. There are also separate BASS, TREBLE and MID-range tone controls for front and rear channels (mounted as dual concentric controls), a master VOLUME control and a separate POWER on-off switch.

The previously referred to Dolby selector switch permits direct playback of Dolbyized FM broadcasts, playback of other Dolbyized program sources, by-passing of Dolby circuits for conventional program sources including internal FM, proper recording of non-Dolbyized signals, and, finally, proper re-recording of previously Dolbyized program sources in a non-Dolbyized fashion.

At mid-panel level, just below dial scale level, are a series of 12 push buttons—six at the left and six at the right. The first of the left-most cluster selects left or right channel calibration of the Dolby level set meter located just above this button. Next is a button which, when depressed, provides a built-in 400-Hz tone for Dolby calibration. The remaining four buttons are used in conjunction with the 'scope display, the first button turning on power to the 'scope, the remaining three determining the type of display that is to be observed, such as audio presentation (for mono, stereo, or four-channel quadrant displays), FM tuning, or FM multipath. The six symmetrically arranged buttons at the right take care of such functions as loudness control, FM muting, low and high fre-

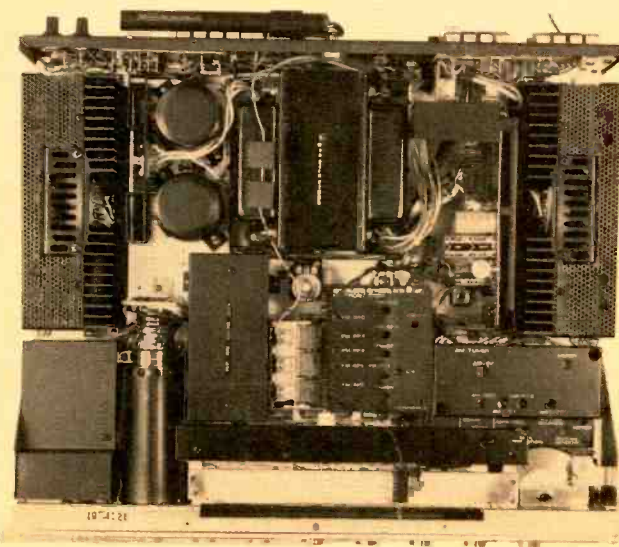


Fig. 2—View of the chassis.

quency filters, and selection of either main or remote (or both) sets of speakers.

Located at center-panel are three slide controls which control front-rear balance, front-left-right balance and rear-left-right balance. The dial scale itself is well-calibrated in both FM and AM frequencies and includes a logging scale and an illuminated dial pointer. Above the dial scale, various written designations light up to denote settings of the mode and program selector switches and there is also the usual stereo indicator light which lights up in the presence of a received stereo FM signal. Four small knobs adjacent to the 'scope display take care of record and playback calibration of the Dolby circuits, and the instructions for these calibration steps are well explained in the instruction manual.

A view of the rear panel is shown in Fig. 1. Speaker connections for both main and remote quartets of speakers are made by means of piano-key spring loaded terminals which virtually preclude the possibility of short circuits. Antenna connections are made to similar terminals. There are a pair of a.c. convenience receptacles below the speaker terminals—one switched, one unswitched—a line fuse, and a selector switch for changing operating mode from four-channel to higher-powered two-channel operation. A detector output jack, identified as "FM Quadradiial Output" is provided for connection to a four-channel FM adaptor at some time in the future. Dolby FM calibration controls for left and right channels, though factory preset, may require readjustment and are therefore brought out to the rear panel for customer access. Vertical and horizontal centering controls, as well as bright-

ness and focus controls are also available for setting up the 'scope display. A muting level control is also located on the rear panel. Jumper blocks are installed between the preamplifier outputs and the main amplifier inputs. These can be removed and the two sections may be used independently. Phono and high-level in-out jacks, tape monitor out and in jacks (two complete circuits), a chassis ground terminal, remote control socket and switch, and an FM de-emphasis switch complete the rear panel layout. This last item represents a bit of foresight on the part of Marantz's designers. Just a few days before this receiver was evaluated, the FCC authorized transmission of FM signals using the Dolby noise reduction process *plus* 25-microsecond pre-emphasis (as opposed to previously employed 75 microsecond pre-emphasis). Owners of the Marantz 4400 and a limited number of other fine tuners and receivers will be able to enjoy this new, more effective Dolby FM broadcasting from the moment it originates in their area.

An internal view of the Marantz 4400 is shown in Fig. 2. Construction is modular and the amount of circuitry contained in this well laid out unit suggests that it could not have been made much smaller in size. Yet, serviceability seems excellent and there is a minimum of point-to-point wiring for all the circuit complexity.

The front-end includes an FET r.f. amplifier, and FET mixer, and a double-tuned tank circuit between stages. The i.f. section contains six transistors and three stages of dual ceramic permanent filters. Symmetrical diode-limited circuits utilize "Hot Carrier" diodes and the i.f. limiter-amplifier is

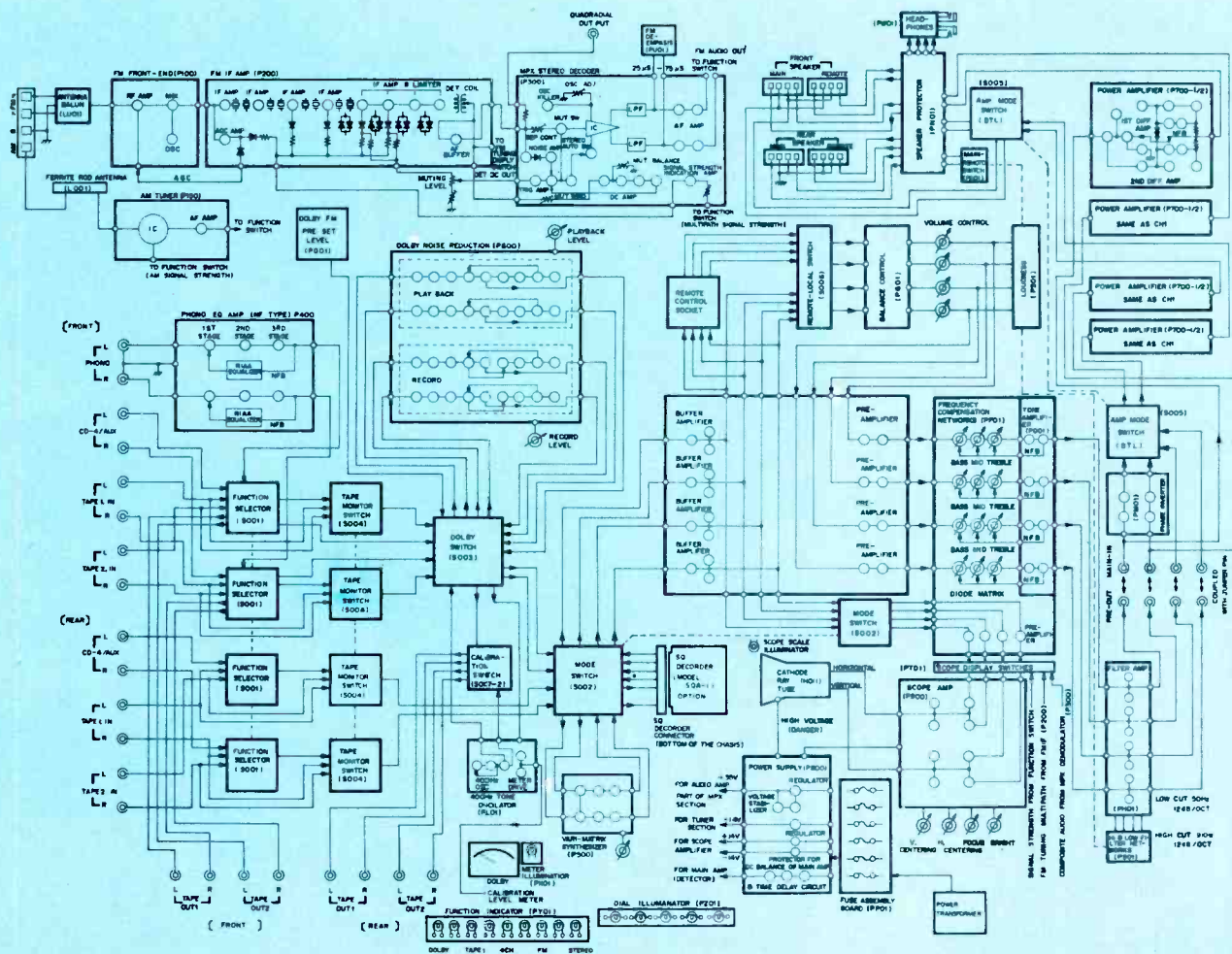


Fig. 3—Functional block diagram.



said to have a small dynamic symmetrical aperture so that distortion-producing AGC circuitry is not required. FM stereo decoding is accomplished by means of a phase-lock-loop IC circuit. Muting circuitry includes a two-transistor noise amplifier and a three-transistor switching circuit. The AM circuitry of the 4400 consists of a multi-purpose r.f.-oscillator-mixer-i.f.-detector IC plus a transistor amplifier. A three-section variable capacitor is used in the AM section.

Tone control circuitry is of the feedback type and utilizes a two-stage direct coupled NPN-PNP configuration with an R-C feedback network. Each power amplifier includes a pre-amplifier stage, driver, electronic protection and output circuits. The amplifiers include direct-coupled differential stages. Silicon output stages are arranged in a full-complementary Darlington format direct-coupled output. The electronic protection circuits, consisting of three transistors and four diodes in each channel, sense peak output current and limit current fed to the driver transistors to a safe maximum value. A block diagram of the entire circuit of the Marantz 4400 is shown in Fig. 3.

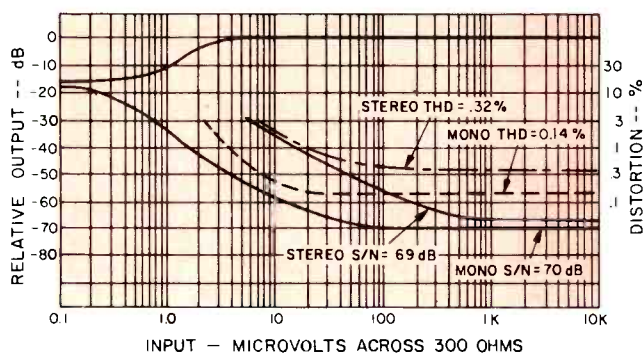


Fig. 4—FM quieting and distortion characteristics.

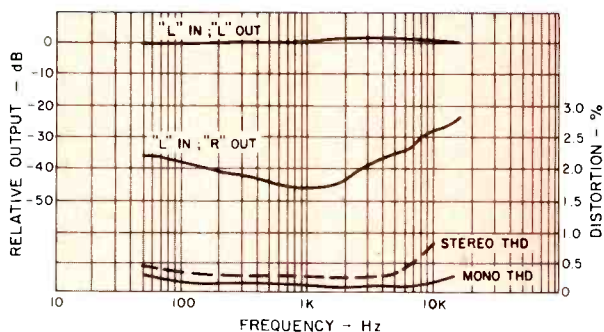


Fig. 5—Separation and distortion vs. frequency.

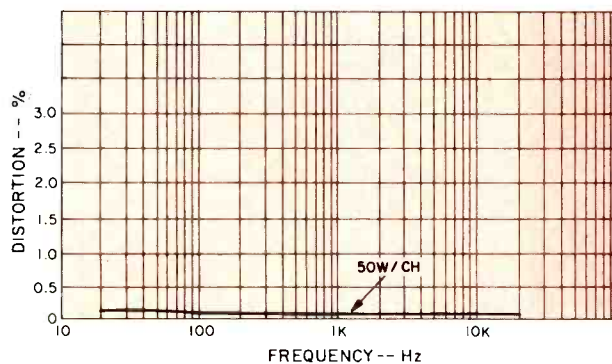


Fig. 6—Harmonic and intermodulation distortion characteristics.

## FM Tuner Measurements

Referring to the published specifications at the start of this report, you will note that Marantz chooses not to mention IHF sensitivity, but prefers instead to reference the signal required to achieve a nominal 30 dB of quieting. While we do not particularly object to this format, it may be confusing to the reader who is accustomed to seeing an IHF sensitivity spec, which combines readings of both residual noise and distortion. As a matter of fact, taking Marantz's statement, they actually do better than claimed, reaching 40 dB quieting at just under 2  $\mu$ V input. However, if it is IHF sensitivity you want to measure, it takes just under 3  $\mu$ V to reach 3% combined residual noise and distortion. 70 dB of quieting was reached with an input of just under 100 microvolts and remained at that level for higher signal strengths, as shown in Fig. 4. Stereo quieting was almost as good, measuring 69 dB without inserting any low-pass filters. This means that 38-kHz and 19-kHz product rejection is excellent too. Ultimate mono THD measured 0.14%, better than claimed, while stereo THD just missed the 0.3% mark at 0.32%.

Stereo separation at mid-band frequencies actually was better than the 42 dB claimed (it measured 47 dB) decreasing to under 30 dB at 10 kHz and to 36 dB at the low frequency end of the spectrum. (See Fig. 5.) Both mono and stereo THD at frequency extremes were extremely low. Even at 10 kHz there was little evidence of intermodulation "beats" in stereo, resulting in a THD reading of well under 1.0%. Stereo sensitivity and threshold were measured at 6  $\mu$ V. Muting level is adjustable from under 5  $\mu$ V up to about 30  $\mu$ V. Capture ratio measured 1.3 dB, a bit better than claimed, while such secondary specs as image rejection, i.f. rejection and spurious response rejection were substantially as claimed in the published specifications. Alternate channel selectivity measured 78 dB, somewhat better than the 75 dB claimed. AM sensitivity on our sample measured 25  $\mu$ V and, since this was the only specification given by Marantz with respect to AM performance, the balance of our AM circuit evaluation was confined to listening tests.

## Amplifier Section Measurements

The Marantz 4400 really comes into its own when considered as a four-channel amplifier. The distortion plots in Fig. 6 show that at all but maximum power output, THD and IM are at just about the level of our audio signal generator (0.015%) and as close to being "distortionless" as it's possible for us to measure. Even full power output is conservatively rated. At 50 watts output per channel, with all channels driving 8 ohm loads, THD was still a low 0.06%. Rated THD was reached at an output of 56 watts per channel under the same driving conditions, and rated IM of 0.15% was read for an output of 58 watts per channel, again with all channels driving 8 ohms. Two-chan. power was 135 w/chan. at rated distortion, 20 Hz—20 kHz.

Even more impressive is the power bandwidth of this brute amplifier (shown in Fig. 7) which extends from 6 Hz to 80 kHz! In trying to plot THD versus frequency, we ran into a problem of having to show an expanded distortion scale on our standard graph presentation, so that for all intents and purposes, it's difficult to read just how low the THD readings really are at the frequency extremes at full rated power output. In case you have trouble interpreting the "almost straight line" curve, suffice it to say that at 20 Hz, the 4400 was still producing its rated power output of 50 watts per channel with less than 0.1% THD and at 20 kHz, the THD for 50 watts output per channel was a mere 0.055%. These results are plotted in Fig. 8.

Phono overload was measured at 120 mV, better than the 100 mV claimed. Phono hum, referenced to 2 mV input and full power output was a very excellent 70 dB. Many manufacturers claim that figure, but few actually attain it, espe-

cially when referenced to such a sensitive, high-gain phono preamplifier circuit. The omission of the RIAA curve from the manual was evidently an oversight on the part of the printer, because in fact, RIAA equalization was accurate from 30 Hz to 20 kHz within  $\pm 0.5$  dB. Overall frequency response extends from 10 Hz to 25 kHz within 0.25 dB, with input applied to any of the high level input jacks. Signal-to-hum level for high level inputs measured a satisfactory 86 dB.

Tone control, filters, and loudness characteristics (for a -30 dB setting from CW position of the volume control) are all shown in Fig. 9. Filter action for both low and high filters is steep and effective in reducing rumble and hiss without seriously affecting response musically. The mid-range control (unlike some) does not provide too much presence boost—just a nice moderate amount which is easily and uniformly controlled and the center of which is at a preferred lower-mid frequency. We liked its action.

### Use and Listening Tests

Considering the FM portion of the Marantz 4400, there's no doubt that a 'scope display for tuning beats any meter arrangement, as we have said in previous reports on equip-

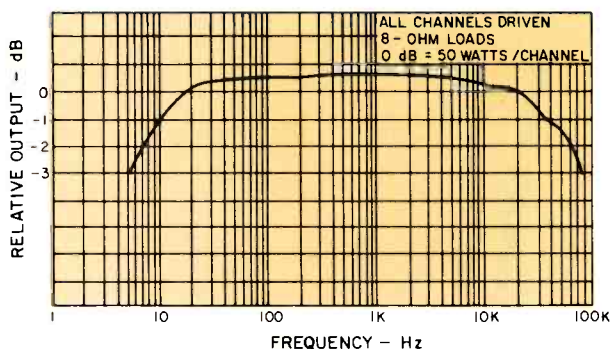


Fig. 7—Power bandwidth characteristics.

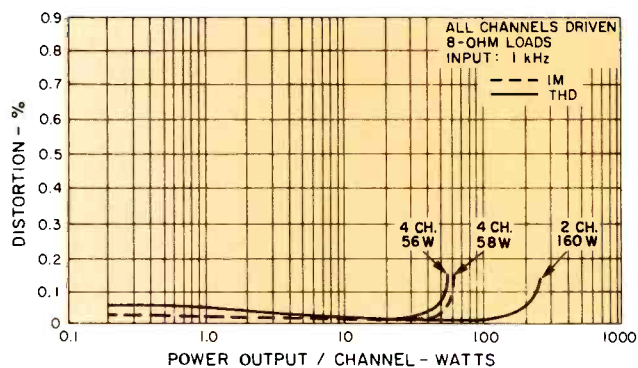


Fig. 8—Distortion vs. frequency.

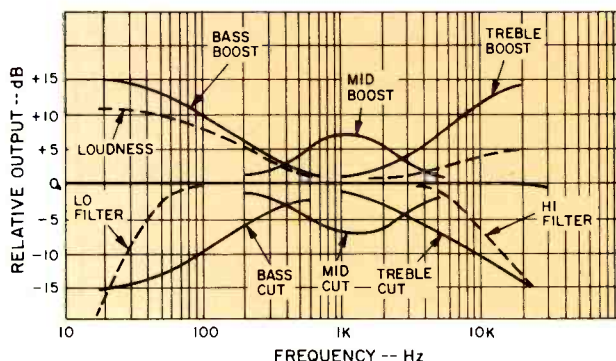


Fig. 9—Tone control range, filter and loudness characteristics.

ment that provides this luxury. In the case of this unit, the display serves a triple purpose. When used for tuning, a vertical bar trace indicates correct center tuning as well as relative signal strength. When the FM multipath button is depressed, degree of station modulation as well as multipath distortion can be easily observed. Finally, the display is useful in observing audio signals in mono, stereo and four-channel modes. We cannot guess what percentage of the cost of the Marantz 4400 is bound up in the 'scope display feature (probably a good 25% of the parts cost), but there is no doubt about its usefulness in every one of its functions.

Aside from the slight discrepancy in quieting sensitivity, the tuner section performed well, with a minimum of audible distortion on all but the very weakest signals. Stereo reception was excellent, with very positive switching occurring between mono and stereo reception. In fact, all the controls of this fine receiver have a very positive feel and transmit a sense of the ruggedness of the entire instrument.

One cannot but help be influenced by the high cost of this receiver in conducting listening tests and use tests. Certainly, the amplifier section of this unit performs flawlessly—fully as well as some of the separate integrated amplifiers and even separate power amplifiers to which we have listened. There is a tightness of bass, and an ease of power handling that is rarely found in all-in-one receivers, least of all four-channel units which often compromise amplifier power and performance in favor of quadraphonic circuit needs. Marantz has chosen the opposite approach. They have designed, first and foremost, a quality quartet of amplifiers, but chosen to leave the choice of system and sophistication up to the user by means of the "hidden pocket" system.

The built-in four-channel synthesizing circuit does do some interesting things for both stereo records and matrix encoded discs. It does not, however, decode them as their producers intended them to be reproduced, nor does it have any logic circuitry, so that separation is minimal and instrumental placement is arbitrary and does not conform to expectations. We checked this out by alternately playing several SQ records, first using the built in four-channel synthesizer and then using a separate, full-logic SQ decoder (not the one supplied as a plug-in module by Marantz). Naturally, the full-logic decoder produces superior results. That means that unless you wish to confine your four-channel listening to discrete four-channel tapes, you're going to have to spend more money for the SQ decoder of your choice. You can purchase either Marantz's SQA-1 (\$49.95) which has front-to-back logic or the SQA-2 (\$79.95) which has full logic. If you want CD-4 record reproduction, you will have to use an outboard demodulator such as Marantz's Model CD-400 (\$99.95). In short, the Marantz 4400 is an excellent piece of electronics in its own right, though not a universal four-channel receiver unless you spend a bit more money than the initial \$1250.00 required to buy the receiver. And keep in mind our arbitrary figure of 15% of the total cost for all the benefits of the triple-purpose 'scope, which amounts to nearly 300 dollars. The additional cost of \$50-100, which is less than competitors' comparable units for a plug-in decoder or demodulator still keeps the price of the 4400 within the range of several other top-of-the-line four-channel receivers. Obviously, Marantz could have easily raised the price even higher and included the extras. The fact that they did not suggests that they believe there may be further improvements in SQ decoding techniques—and they may well be correct in this surmise. In any case, with the externals added, this receiver is in no way a "compromise" design because of its four channels of audio. In fact, when the pairs of amplifiers are operated together for stereo listening, there aren't too many receivers around that can deliver its 125 watts per channel so effortlessly at any price.

Leonard Feldman

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