

# Rotel RB-991 power amplifier

**A**s a reviewer who has focused on seeking out high-quality audiophile gear for cost-constrained readers, I'm embarrassed to say that the flagship RB-991 stereo amplifier is the first Rotel product I've had in my house. (To be fair to myself, this 38-year-old family-owned company did not develop a large US market presence until this last decade.)

Rotel's philosophy of audio design is consistent with my own taste as a reviewer. As explained in Rotel's US dealer training manual (143 pages, with multiple-choice review questions at the conclusion of each chapter), the company's focus is on "balanced design." Rotel eschews "price-no-object" designs (narrows the market unnecessarily) and "mass appeal," feature-laden products (which have no impact on sound quality or reliability). All of Rotel's "balanced designs" feature:

- 1) high-quality parts sourced from specialty manufacturers, to ensure reliability and sonic advantage;
- 2) circuit topology designed to minimize signal paths and to keep each channel's signal path identical to preserve soundstaging; and
- 3) critical evaluation—listening panels determine the subtle sonic attributes of different parts or circuit layouts.

## Serious design

How is this design philosophy implemented in the execution of the \$999, 200Wpc RB-991? The power supply is based on a multiple-secondary toroidal transformer rated at 1.2kVA. From the transformer on, each channel's power supply is separate, with individual rectifier arrays and banks of BHC slit-foil capacitors. According to Rotel, 20 output devices (10 per channel) are employed to maximize stability and reliability under extended high-output conditions. The dual-differential input with constant-current source feeds a class-A voltage-amplifier stage, which leads in turn to the triple Darlingtons output section. The circuit employs Black Gate and Wima capacitors and Roederstein metal-film and Vishay military-grade resistors. The amp features switchable



Rotel RB-991 integrated amplifier

balanced and unbalanced inputs. Costs are kept to a minimum by manufacturing this British/Japanese-designed amplifier in China.

## Serious sound

The RB-991's strengths were apparent in the first hour of listening, and their combination presented a level of sonic realism I did not think possible in a high-powered amplifier at this price:

- *Extraordinary Resolution of Detail*—After 15 years of owning expensive high-resolution audiophile gear while reviewing affordable components, I've gotten used to a two-tiered performance regime of detail resolution: the schools of "cost no object" and "good resolution for the price." The Rotel RB-991 is the first high-powered (ie, 100Wpc or greater), low-cost basic amplifier I've heard that resolves detail at a level I've come to expect from amplifiers in the \$3000–\$5000 range.

On Kohjiba's *Transmigration of the Soul*, from *Stereophile's Festival CD* (Stereophile STPH007-2), the inner detail and decay of the flute and percussion were easy to discern, as was a sense of the sound of the hall, and the bowing techniques of the violinists and cellist. And the pitch definition of the drums and the low-level dynamic articulation of the percussionists on John Cage's *Third Construction*, from *Pulse* (New World/Classic NW 319) resulted in a lifelike, involving presentation of this stunning work.

- *Highly Defined and Extended High Fre-*

*quencies*—The Rotel's high frequencies were pure, clean, and extended throughout the top three octaves, without sounding harsh or metallic. Janis Ian's voice on *Breaking Silence* (Analogic Productions APP 027) had unusually intelligible sibilant articulation, and the subtle percussion textures were clearly defined and palpable.

- *Midrange Neutrality*—The RB-991's midrange was neither rich and tubelike nor thin and restrained. On vocals, jazz, rock, or orchestral music, all instruments and vocals were reproduced without a hint of coloration. Mighty

**Description:** Solid-state stereo power amplifier. Output: 200Wpc into 8 ohms (23dBW), 300Wpc into 4 ohms (21.8dBW). Frequency response:  $\geq 10\text{Hz}$ –100kHz,  $\pm 1\text{dB}$ . Damping factor:  $>500$ . Total harmonic distortion:  $<0.03\%$ . Intermodulation distortion:  $<0.03\%$ . Signal/noise ratio: 120dB.

**Dimensions:** 17" W by 5" H by 15" D. Weight: 37 lbs.

**Price:** \$999. Approximate number of dealers: 200.

**Serial number of unit reviewed:** 748 136040.

**Manufacturer:** Rotel of America, 54 Concord Street, North Reading, MA 01864. Tel: (978) 664-3820. Fax: (978) 664-4109. Web: [www.rotel.com](http://www.rotel.com)



Sam McClain's voice on *Give It Up to Love* (LP, AudioQuest Music AWLP 1015) was in its natural burly, growly state, with all subtle inflections reproduced by the Rotel's excellent articulation of low-level dynamics. Furthermore, one could hear the exact point where the Hammond B-3's tubed Leslie speaker just trips into distortion—a point I know too well from the many nights I've shared onstage with the wooden keyboard beast.

On "Round Midnight," from *Clap Hands, Here Comes Charlie!* (LP, Verve/

Classic V6-4053), Ella Fitzgerald's emotive and seductively delicate voice melted me into a puddle.

King Crimson's "Easy Money," from *Larks' Tongues in Aspic* (LP, Island ILPS 9230, UK pressing) is a good test for midrange timbre and detail reproduction. Vocals are unprocessed and unenhanced on this recording; with the Rotel, they were tactile and natural. The minimalist drum kit, as well as percussion "and allsorts" (*ie*, shakers, crunchers, and the shimmering deacon chimes), were perfectly suspended in space with a long,

resonant decay, and shone in all their nonresonant, uncolored glory.

In other areas, the Rotel continued to impress. Bass was tight, extended, and tuneful, and the amplifier delivered realistic low- and high-level dynamic swings on all program material. Soundstage width, depth, and image specificity were beyond reproach.

So is the Rotel the perfect budget amplifier? Well, not quite—the detailed and pristine high-frequency presentation were double-edged swords. Sure, the highs were uncolored, de-

## Measurements

The measurements of the Rotel RB-991 were made primarily in unbalanced mode, though selected readings were taken in balanced operation. Unless otherwise noted, the results discussed here refer to the unbalanced connection.

Following its preconditioning test, the Rotel RB-991 was very warm, but not unusually so for a high-powered amplifier. Its voltage gain measured 31.8dB unbalanced, 24.9dB balanced. The input impedance measured 36k ohms (45.2k ohms balanced). DC offset was a highish 22.1mV in the left channel, 13.1mV in the right. The RB-991 is noninverting—a positive-going input emerges positive at the output. (Pin 2 of the balanced input is wired as positive.) The unweighted S/N ratio at 1W into 8 ohms was 89dB over a 22Hz–22kHz bandwidth, 83.3dB from 10Hz to 500kHz, and 90.0dB A-weighted. The corresponding balanced S/N figures measured somewhat worse: 83dB, 74.3dB, and 85.5dB, for the same respective conditions.

The RB-991's output impedance varied from 0.04 to 0.05 ohms, the higher value occurring at 20kHz. This should not affect its frequency response with varying loudspeaker loads in any audible way (fig.1). The small dip at 5kHz is the only change visible when the amplifier is

driven into our simulated loudspeaker load. The 4 ohm result was the same as the 8 ohm measurement and is not shown; the same is true of the balanced response. The 10kHz squarewave from the RB-991 is shown in fig.2. Apart from the slight rounding of the leading edge found in almost all amplifiers, this is an excellent result, as is the nearly perfect 1kHz squarewave (not shown).

At 102dB at 1kHz, reducing through capacitive coupling to 78dB at 20kHz, the unbalanced channel separation (not shown) is more than adequate to render any possible audible effect moot. As with the S/N, the balanced measurements were a little worse than the unbalanced, the crosstalk increasing by 10dB on average.

Fig.3 shows the small-signal THD+

noise percentage plotted against frequency. The 2 ohm result shows a slight increase at high frequencies, but this is not unusual, and overall this is a very good result. The balanced THD+noise into 8 and 4 ohms (not shown) is slightly higher than the unbalanced—approximately 0.02% across the entire spectrum. The 1kHz THD+noise waveform at 200W (!) output into 4 ohms is shown in fig.4. The high output was used to capture the waveform because at lower output it was buried in low-level noise. The result is heavily second-harmonic, though higher harmonics are evident.

The distortion spectrum resulting from a 50Hz input at 268W into 4 ohms is shown in fig.5. All of the artifacts are below –90dB (0.003%), an excellent re-

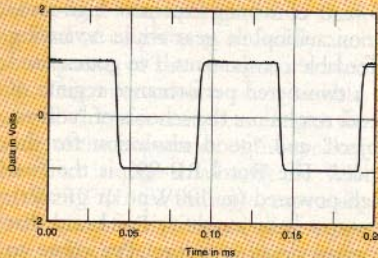


Fig.2 Rotel RB-991, small-signal 10kHz squarewave into 8 ohms.

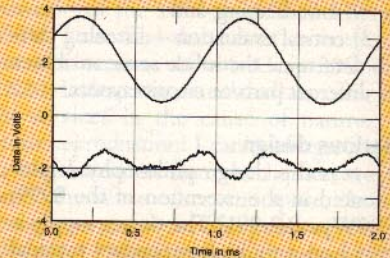


Fig.4 Rotel RB-991, 1kHz waveform at 2W into 4 ohms (top), distortion and noise waveform with fundamental notched out (bottom, not to scale).

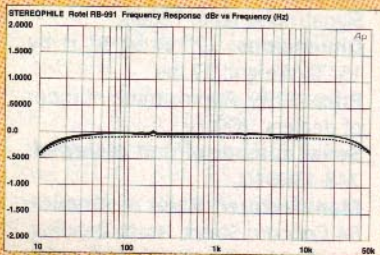


Fig.1 Rotel RB-991, frequency response at (from top to bottom): 1W into 8 ohms, and 2.828V into simulated loudspeaker load (0.5dB/vertical div, right channel dashed).

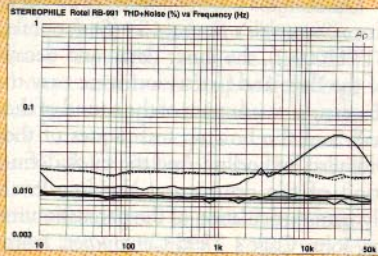


Fig.3 Rotel RB-991, THD+noise (%) vs frequency at (from top to bottom at 1kHz): 4W into 2 ohms, 2W into 4 ohms, 1W into 8 ohms, and 2.83V into simulated loudspeaker load (right channel dashed).

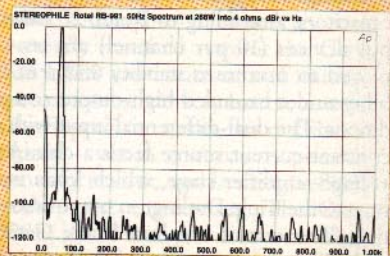


Fig.5 Rotel RB-991, spectrum of 50Hz sinewave, DC–1kHz, at 268W into 4 ohms (linear frequency scale).



tailed, and extended, without a trace of bite or harshness, but they were also a bit prominent and forward and not in the least relaxed, in the way a more expensive tube or solid-state amp can be without losing extension.

For example, on Sibelius' Violin Concerto (RCA/Classic LSC-2435), Jascha Heifetz' violin was searing yet sweet, but overly forceful, with the upper harmonics of his violin a bit too prominent. Similarly, "Take the A Train," from Bill Berry's *For Duke* (M&K Realtime RT 101), sounded natural and detailed

throughout the melody and solos, but when the trumpet tuttis come in near the end, they seemed a bit forward and in your face.

The bottom line is that the balance of the high frequencies' strengths and weaknesses will be a personal decision based on listening biases, equipment matching, and selection of listening material. The purity and detail of the Rotel RB-991's high frequencies are, indeed, two of its greatest strengths, but...during long listening sessions on a revealing system with source material that was not of uniformly

high quality, the amp's overall sonic presentation did, at times, grow fatiguing.

**Competition?**

I compared the Rotel with the similarly priced and powered NAD 218 THX amplifier that I review elsewhere in this issue, as well as with my considerably more expensive Audio Research VT100 Mk.II. The Rotel and the NAD were exemplary performers representing excellent value, but gave quite different sonic presentations. The Rotel's overall neutrality and exceptional detail resolu-

sult. The 19+20kHz IM spectrum at 214W into 4 ohms (the maximum output with this test signal before visible signs of clipping appear) is plotted in fig.6. The 1kHz intermodulation artifact is at -86.4dB (0.005%), the 18kHz artifact at -75.2dB (0.017%), both excellent results. The 19+20kHz spectrum at 107W into 8 ohms is nearly the same

and is not shown.

The RB-991's THD+noise vs level curves are shown in fig.7. The amplifier is not rated into 2 ohms; when I tried to run a 2 ohm test anyway to include in fig.8, the amplifier blew its power-supply fuses at just above 400W output. No damage resulted, and replacing the fuses restored normal operation. I made

no further attempt to determine the amplifier's output power with a 2 ohm load. The RB-991's discrete clipping on continuous tones is shown in Table 1.

John Atkinson used the Miller Audio Research amplifier profiler to test the Rotel's maximum power output on a toneburst signal that more closely approximates a music signal, 10 cycles of 1kHz followed by 40 cycles off. Under these conditions, the modest-looking Rotel proved a powerhouse, delivering 281.5W into 8 ohms, 539W into 4 ohms, 974 W into 2 ohms, and 1615W into 1 ohm. The latter corresponds to an RMS current of 40A by the way! This behavior is shown graphically in fig.8, which reveals the distortion floor to rise in inverse proportion to the load impedance. Nevertheless, even into the punishing 1 ohm load (green trace), the THD remains below -70dB (0.03%) until the 1300W level. That the Rotel should do well on this toneburst test is no surprise, as Rotel's Chinese factory uses the Miller amplifier profiler for production line testing and quality assurance.

The measured results for the RB-991's unbalanced operation slightly exceed those for the balanced mode. This is not particularly unusual, and the amplifier's test-bench performance is excellent in either setup. It is probably best to keep the loudspeaker load above 4 ohms, however, as Rotel recommends. — Thomas J. Norton

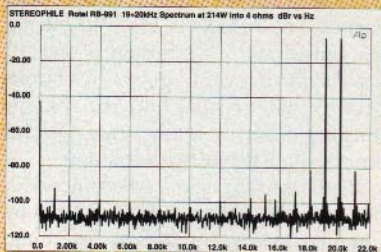


Fig.6 Rotel RB-991, HF intermodulation spectrum, DC-22kHz, 19+20kHz at 214W into 4 ohms (linear frequency scale).

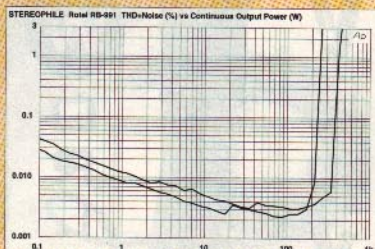


Fig.7 Rotel RB-991, distortion (%) vs continuous output power into (from bottom to top): 8 ohms, 4 ohms.

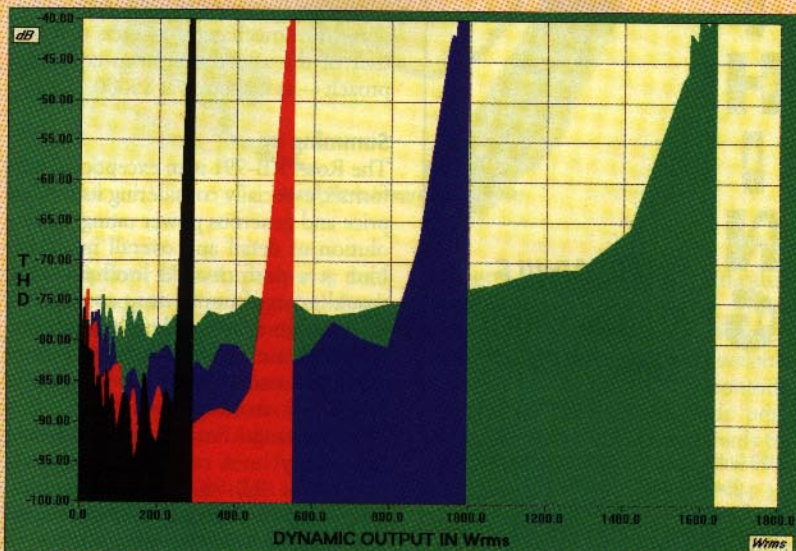


Fig.8 Rotel RB-991, distortion (%) vs burst output power into 8 ohms (black trace), 4 ohms (red), 2 ohms (blue), and 1 ohm (green).

Table 1 Rotel RB-991: Clipping (1% THD+noise at 1kHz)				
Load ohms	Both Channels Driven		One Channel Driven	
	W (dBW)	(L) (R)	W (dBW)	(L)
8	219.2 (23.4)	217.8 (23.4)	238.7 (23.8)	(line) 114V 114V 113V
4	349.1 (22.4)	345.9 (22.4)	416.5 (23.2)	(line) 112V 112V 114V



## Associated Equipment

**Analog source:** VPI TNT Mk.IV turntable, Immedia tonearm, Koetsu Urushi cartridge.

**CD players:** California Audio Labs Icon Mk.II and Delta/Sigma II.

**Preamplification:** Vendetta Research SCP-2D phono stage, Audible Illusions Modulus L1 line stage.

**Loudspeakers:** Acarian Systems Alón Circe, Alón V Mk.II, Mission 731i.

**Cables:** MIT MI350 CVTwin Terminator and MI330 Shotgun interconnects, Acarian Systems Black Orpheus speaker cable.

**Accessories:** Various items from VPI, Sound Anchor, SimplyPhysics, ASC, Bright Star, TG Audio Labs.

—Robert J. Reina

tion hinted at a performance level that one would expect at higher price ranges, but its ruthlessly revealing high frequencies resulted in a less than musical experience with recordings of lesser quality. The NAD, on the other hand, was quite soft and forgiving overall (except for its scarily powerful bottom octave), with a rich, tubelike dimensionality offset by a thick midbass and limited high-frequency resolution.

Both amplifiers are recommended, but again, the choice will be dictated by listening biases, equipment matching, and, perhaps, musical taste. Neither amp, however, could hold a candle to the ARC, which offered a level of refinement, delicacy, neutrality, and freedom from mechanical artifacts that neither of the affordable amps could approach — as it should, at \$5000.

## Summing up

The Rotel RB-991 is an exceptional performer, especially considering its modest price and generous power rating. Its resolution of detail and overall neutrality hint at a performance level that one would expect from an amp costing two or three times as much. Although one might obtain a higher level of refinement and resolution by spending up to \$2000 on an amplifier in the 100–200Wpc range, I'm not sure that would necessarily be a cost-effective investment. The RB-991 may be the ideal amp for those who are willing to spend \$2000 for an amp, but who really wish they could find an extra thousand to invest in their front-end or speakers. 