DITHER Ye Not

Does Rotel's new heavyweight CD player pack much of a punch? Paul Miller finds out.

Hi-Fi Choice issue 184 paid witness to Rotel re-establishing itself as major force in the CD market with its £350 RCD-971 player. Not content with peppering the opposition, Rotel has unveiled its biggest gun yet – the £750 RCD-991 – with the obvious intent of landing a musical shell among the affordable 'high end' elite. And, as we'll discover, this heavyweight has an unusual addition to its armoury of features.

Rotel's RCD-991: gives you the full whack, plus a bit of a surprise extra.

The RCD-991's imposing architecture is new to these shores, but will be familiar to German and US audiophiles who experienced its lookalike predecessor, the RCD-990. As before, the company has provided both single-ended (phono) and balanced (XLR) analogue output options with a switchable digital output should you wish to use an external DAC, CD-R or MD recorder, for example.

A comprehensive display and track calendar sits above the CD drawer while all functions – save for track skip, play and pause – are relocated onto the RR-D93 remote handset. Here you'll find direct track access along with the usual random, program and repeat play modes.

Alongside the main display is another, single-digit display which has the distinct appearance of being 'tacked-on' afterwards. This indicates the level of digital dither, selected from the front panel and applied during playback (*see box*).

UNDER THE BONNET

The RCD-991 marks a state-of-the-art implementation of Burr-Brown's 20-bit PCM63P DACs. Jitter is low at 210psec and completely free of low-rate, PSU-induced or noise-like jitter, which might otherwise compromise its stereo imagery. Decoding for Pacific Micro-sonics' HDCD software is also provided as an integral part of the PMD-100 8x oversampling digital filter (see *Oasis*, *HFC* 182, for a more detailed explanation of HDCD).

This filter affords a superb rejection of digital images and ultrasonic noise (see figure one below), promising broad compatibility with a wide variety of amplifiers.

The highest grade version of these DACs, meanwhile, ensures very low distortion (just 0.0025 per cent at -30dBFs) with errors in low-level linearity below 1dB over a full 100dB dynamic range.

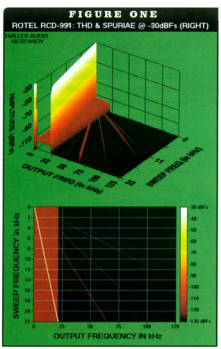
This really is about as good as it gets using existing 20-bit technology, while the analogue output section is equally 'bullet-proof', even including the +6dB gain scaling required by HDCD.

> **"This really is about as good as it gets using existing 20-bit technology, while the analogue output section is equally 'bullet-proof', even including the +6dB gain scaling required by HDCD."**

Lower-cost implementations of this filter (including the Rotel RCD-951 and RCD-971) will typically scale HDCD's extra headroom in the *digital* domain but this fails to optimise the dynamic range of the DAC with standard (non-HDCD) recordings.

Less well known is the fact that this HDCD filter may be operated with or without an external microprocessor. Implemented in the former manner, Rotel's engineers have accessed the PMD-100's internal dither circuit. Modes 1-6 employ increasing levels of an ultrasonic (30-80kHz) dither while mode 7 uses a low-amplitude dither with what's known as a triangular PDF (Probability Distribution Function). Please see the 'Dither' box for more details.

FIGURE ONE
ROTEL RCD-991: THD & SPURIAE @ -30dBFs (RIGHT)



LISTENING TESTS

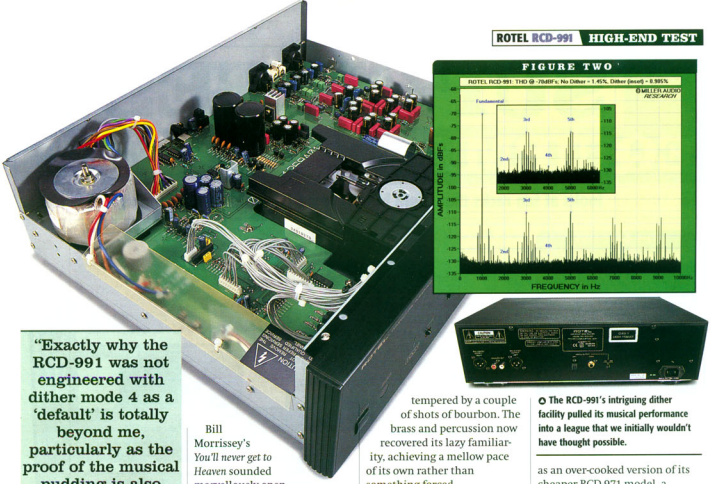
Our panellists' ears were warmed at the outset of our listening session by an extended turn from our reference Theta Data Basic/DSP Pro progeny combination before the RCD-991 – or player 'X' to our panel – was selected behind closed doors. As ever, my thanks go to our blind but diligent panellists: Roger Batchelor (Denon), Kevin Edwards (Talk Electronics) and Mark Hockey (Kenwood UK).

Initially, our listeners appreciated the warm but clean and incisive bass that provided a crisp foundation to the likes of Christy Moore's *Reel in the Flickering Light*.

But things proved a little less smooth and civilised through mid and treble, as Christy's natural sibilance was exaggerated, a lisp that was underscored by an unwelcome splash of percussion.

This coloration might not have dampened the jaunty and enjoyable storytelling atmosphere of the track as whole, but we would rather have not have listened 'through' this extra hardness. 'After all,' one listener said, 'this was a studio recording, not a folk-club PA system.'

In similar fashion, the player fairly rampaged through Whiskeytown's *Strangers Almanac*, the drummer attacking the drums in a fashion quite at odds with the softer 'padding' heard with our reference combination.



"Exactly why the RCD-991 was not engineered with dither mode 4 as a 'default' is totally beyond me, particularly as the proof of the musical pudding is also clearly evident in the lab."

In the event, we really wished for something in between, not killing the music's natural gusto but neither fraying our nerves. 'It's the difference between a vocalist singing his heart out rather than yelling into the microphone,' mused one panellist.

To this end, repeat auditions with Pacific Microsonic's dither options proved a godsend. Dither settings 1-3 provided a mild restraint of the RCD-991's raunchy disposition.

Bill Morrissey's *You'll never get to Heaven* sounded marvellously open and expressive, the strong and confident bassline driving the big sound forward, even if the brass still betrayed a hint of extra aggression.

But it was dither setting 4 that transformed this player. Subtle textures that weren't even hinted at with the Bill Morrissey track using dither setting 1, now filled the scene with added and realistic colour, from bass right the way through treble.

Drums sounded cleaner and more resonant, the double bass and snare drum more believable, just as his voice returned to its smoky norm, tempered by a couple of shots of bourbon. The brass and percussion now recovered its lazy familiarity, achieving a mellow pace of its own rather than something forced.

Without drastically changing the overall presentation, the tonal balance and colour of the music was now simply so much easier on the ear, relaxed and natural sounding. With an unmistakable, unhurried ease infused into its performance, the RCD-991 was brought smartly in line with the Theta combination – 'You've just added £1,000 on to its price tag,' said one listener. All this by the simply introducing a soupçon of 'digital noise'.

The RCD-991's intriguing dither facility pulled its musical performance into a league that we initially wouldn't have thought possible.

VERDICT

Just when we thought that Rotel's RCD-991 might emerge as an over-cooked version of its cheaper RCD-971 model, a careful exploration of its dither facility taught us otherwise.

In standard mode, the RCD-991 can possess a hint of roughness and hardness that's almost perfectly ameliorated with dither engaged, restoring the sort of diction, clarity and subtlety that's evidently comparable with the costliest CD references.

With the correct dither engaged, this CD player is clearly perfectly capable of an exceptional performance. So exactly why the RCD-991 was not engineered with dither mode 4 as a 'default' is totally beyond me, particularly when the proof of the musical pudding is also clearly evident in the lab.

My advice? Just make sure that the extra little window reads '4' before you reach to press 'play'!

DITHERING ABOUT DIGITAL

In *Oasis, HFC* 187, we looked at how analogue music is first sampled and then quantised into a series of 16-bit numbers, or 'words'. With 16 bits of resolution at its disposal, the CD format describes the level of one sample after another (each musical sample is like a snapshot in time) using one of 65,536 (216) binary numbers.

This seems like a lot of numbers, but the full range is only available for the loudest musical sounds. Quieter sequences have a progressively smaller batch of these numbers to call upon, so their precise level is less accurately described. This 'guesstimation' leads to what are called quantisation errors and explains why distortion increases with quieter rather than louder sounds in (linear PCM) digital audio.

The lower the signal level, the greater is the impact of these errors until they are no longer random but generate grim, odd-order distortion harmonics of the signal itself. Digital dither, a 'mathematical noise', is used to 'confuse' these errors once more and trade a reduction in the appearance of the distortion harmonics for an equivalent increase in background hiss. Because the hiss or noise is spread over a wider area than a single distortion harmonic, its effect is far less obnoxious. All this is achieved within Pacific Microsonic's PMD-100 digital filter.

In practice, the PMD-100's 'Mode 7' (low-amplitude Triangular PDF) dither is better suited to life with bitstream-style converters and has little or no effect on the RCD-991's performance. Instead, errors in its multi-bit PCM63P converters are more readily linearised by the weighted ultrasonic dither modes 1-6.

The middle setting, mode 4, offers a reduction in distortion of about 4-5dB at -60dBFs to -80dBFs. Figure two (above) shows this by the reduction in amplitude (height) of odd-order (3rd, 5th) distortion harmonics at low signal levels when dither is applied (inset graph). For clarity, the 2nd, 3rd, 4th and 5th distortion harmonics are identified by blue markers.

Interestingly, because Pacific Microsonics introduces its own high-frequency dither during HDCD encoding, it's non-HDCD software that really benefits from this ingenious facility.

VERDICT

SOUND	★★★★★
BUILD	★★★★½
VALUE	★★★★★
PRICE	£750.00

Rotel has a winner on its hands with the RCD-991, by taking advantage of the variable dither options in its filter it has produced a giant slaying player.

■ TWO YEAR GUARANTEE

☎ Gamepath (01908) 317707