EQUIPMENT **PROFILE**

MARANTZ DD-92 DCC RECORDER

The best way to describe the top-of-the-line Marantz DD-92 Digital Compact Cassette deck is to call it a truly elegant machine. It employs high-quality, 18-bit A/D converters, more than necessary to achieve the dynamic range of 100 dB claimed by the manufacturer. In addition, the DD-92 differs from Marantz's other DCC deck, the lower priced DD-82, by its use of a fully shielded copper chassis and hand-selected, audiophile-grade, passive components. In their D/A stages, both decks use 20-bit digital filters with eight-times oversampling, feeding into bitstream D/A converters. According to Marantz, this is the same D/A stage used in the company's reference-grade CD player, the CD-11 Mk2, which has a suggested price of $2,500.

The convenience features include an easy-to-read text display for information contained on prerecorded DCC tapes, timer recording (when connected to an external timer), and audible fast search in either direction while a tape is playing. You can insert 3-S silent passages (even during playback mode) and mark long sections to be skipped in playback. Track-start ID markers can be inserted, as can end-of-side markers (to trigger an immediate reverse) or "Next" markers (to end recording on one side but wind to the start of the next side before resuming). Tracks can also be renumbered automatically, and any marker can be manually erased.

Control Layout

Controls are sensibly laid out on the traditional Marantz champagne-gold front panel, with major controls in the most prominent positions. A "Power" switch and "Timer" selector are at the lower left of the panel. Only the power switch can turn the deck completely off, but the remote can place it in "Standby" mode (indicated by an LED), with enough control circuitry running to let the remote turn the DD-92 on again. Small buttons under the cassette drawer handle the manual marker functions, and an "Open/Close" button is below and to the right of the drawer. Beneath the large display are buttons for tape monitoring, resetting the counter, counter "Time" (absolute time, track time, remaining time, or counter), and text display modes plus "Repeat," "Blank Skip," and Auto Music Scan ("AMS"). The large buttons to the right of the display are standard

SPECS

Digital Cassette (DCC)

Frequency Response (±0.2 dB): 48-kHz sampling, 10 Hz to 22 kHz; 44.1-kHz sampling, 10 Hz to 20 kHz; 32-kHz sampling, 10 Hz to 14.5 kHz.

S/N (A-Weighted): Greater than 103 dB in playback.

Dynamic Range: At least 100 dB.

THD: Less than 0.003% at 1 kHz in playback.

Channel Separation: 100 dB at 1 kHz in playback.

Analog Cassette

Frequency Response (±3 dB): 20 Hz to 18 kHz, with Type II tape.

S/N (A-Weighted): Without NR, greater than 59 dB on Type II tape.

Wow and Flutter: 0.035% wtd. rms or less.

General Specifications

Output Level: Analog, 2 V at fixed output, 0 to 2 V at variable output; digital coaxial, 0.5 V peak to peak; digital optical, –19 dBm.

Output Impedance: Analog, 1.5 kilohms; digital coaxial, 75 ohms.

Power Requirements: 35 watts, 120 V, 60 Hz.

Dimensions: 17⅞ in. W × 5¾ in. H × 14¼ in. D (45.4 cm × 14.6 cm × 36.2 cm).

Weight: 28.7 lbs. (13 kg).

Price: $1,200.

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For literature, circle No. 90

tape-transport functions (though with a rocker for forward and reverse playback) plus the forward and reverse track-selection buttons familiar from CD players. Just below are buttons for "Record," "Append," and "Rec Mute." Pressing "Append" positions the DCC tape for recording and sets the deck in record/pause mode. If the tape is blank, a lead-in buffer area is set up at its beginning; if the tape has been recorded, the final 10 S of the last recording on it is played. To record over part or all of a recorded DCC, you press "Append" along with various tape-transport buttons.

A headphone jack is along the lower section of the panel, as are knobs and buttons for headphone level, Dolby NR selection, "Auto Start" (which toggles automatic start-ID marking on and off), "Sync Record" (for synchronizing the start of the recorder and a CD player via Philips

PERHAPS THE MOST OUTSTANDING ASPECT OF THE DD-92 WAS ITS SUPERB LOW-LEVEL LINEARITY.

ESI bus links), "Input Select" (analog, digital optical, or digital coaxial), and recording balance and master level controls.

In addition to showing text, the display area features a bar-graph stereo level meter, indications for track, time/counter, and "Mode," as well as the status of a number of other functions to let you know exactly what the deck is doing at any given moment. The supplied remote control duplicates just about all of the control functions on the front panel and has number buttons for accessing a given track directly.

The rear panel of the DD-92 is equipped with variable and fixed pairs of analog output jacks, coaxial digital in and out jacks, Toslink optical input and output connectors, input and output jacks for a system remote link to other components, and an "External/Internal" switch that selects control via the link or the supplied remote.

Measurements

When I first starting testing CD players some 10 years ago, I was concerned that all of them would sound and measure pretty much the same. (Remember the ads that promised "Perfect sound—forever"?) As we all know, that concern was ill founded. The same applies to DCC equipment. While all DCC components use the same PASC algorithm for bit-rate reduction, other design elements will vary from model to model. Marantz has taken the high road with the DD-92, as evidenced by just about all the bench and listening tests I performed.

Figure 1A shows the DD-92's frequency response through the entire record/play cycle, using the analog inputs. Results surpass the claimed tolerance of ±0.2 dB from 20 Hz to 20 kHz. Deviation from ruler-flat response was even less when I applied a sweep of frequencies via the coaxial or optical digital inputs (Fig. 1B). I wanted to keep all tests of frequency response together, so I slipped in an analog calibration cassette supplied by BASF and measured response for this Type II tape (Fig. 1C). The spot frequencies on the tape extend from 31.5 Hz to 18 kHz; at the high-frequency extreme, the roll-off amounts to exactly the 3 dB claimed by Marantz.

Next, I assessed harmonic distortion plus noise as a function of frequency (Fig. 2). Recording via the analog inputs and measuring at

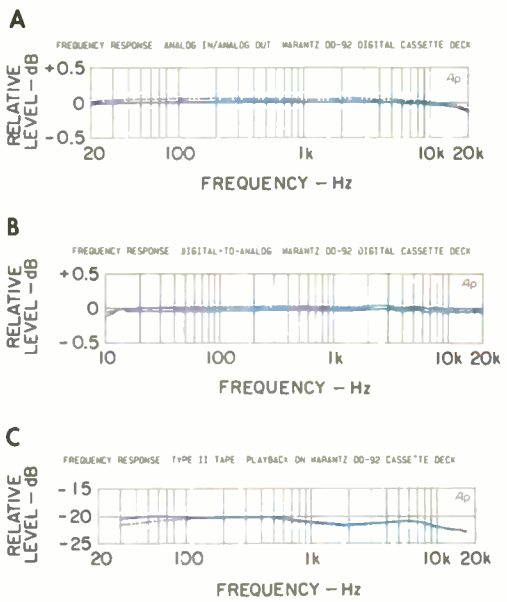

Fig. 1—Frequency response for digital recording via analog inputs (A) and digital inputs (B), and for playback of analog test tape (C; note change of scales).

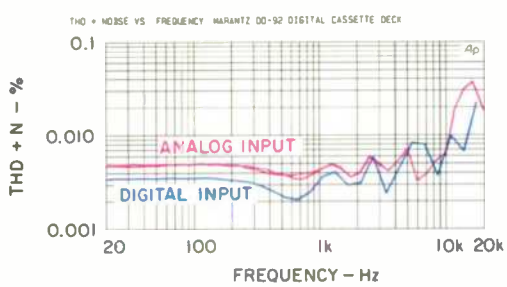

Fig. 2—THD + N vs. frequency for recording via digital and analog inputs.

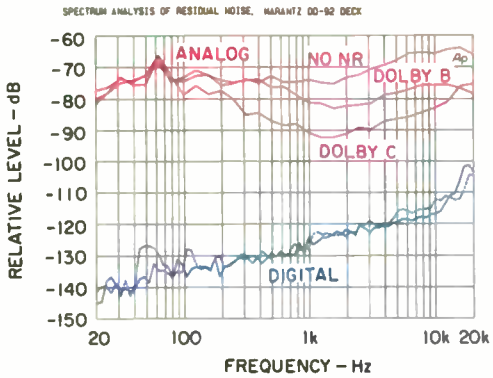

Fig. 3—Spectrum analyses of residual noise when playing DCC copy of "no-signal" CD track and of analog cassette.

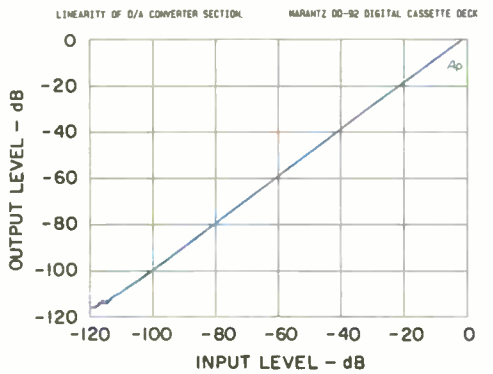

Fig. 4—Linearity at 500 Hz.

the analog outputs, I found that THD + N at 1 kHz is around 0.004%, increasing to about 0.04% at 17 kHz. Recording via the DD-92's digital inputs, I obtained even lower THD + N, from a minimum of just over 0.002% at 650 Hz, to just over 0.003% at 1 kHz, and reaching a maximum of just over 0.02% at 18 kHz.

Reverting to analog playback, I inserted a "no-signal" recorded tape that I normally use to measure S/N ratios on analog cassette decks. Results, plotted as a function of frequency, are shown in Fig. 3 for playback without noise reduction and with Dolby B and Dolby C NR. For the Type I tape I used, the A-weighted overall readings were 55.8 dB without noise reduction, 65.2 dB using Dolby B NR, and 72.8 dB using Dolby C NR. In all likelihood, these numbers would have been a bit better, and met Marantz's claims, if a Type II tape had been used.

Having transcribed the contents of my CBS CD-1 test CD to DCC tape, I played back the "no-signal" track of that tape and plotted an analysis of the residual noise as a function of frequency, using a third-octave bandpass filter. Results were astounding, with residual noise never exceeding –100 dB at any frequency (bottom curve, Fig. 3). A reading of A-weighted noise yielded overall numbers of –103.87 dB for the left channel and –106.21 dB for the right channel, referred to 0-dB (maximum) digital record level. I had viewed the manufacturer's specification with some skepticism until I made this test. Obviously, Marantz's choice of 20-bit digital filtering with eight-times oversampling, and their use of the latest generation of bitstream D/A converters, play an important role in achieving this excellent S/N ratio.

EIAJ dynamic range in the digital record/play mode was 100.79 dB for the left channel and 100.42 dB for the right channel, exceeding the unusually high published specification by a fraction of a dB.

Perhaps the most outstanding aspect of the Marantz DD-92 was its superb low-level linearity. Using a prerecorded test tape supplied by Philips, I plotted output linearity versus input from 0 down to –90 dB (not shown). I could detect no significant deviation from perfect linearity over that entire range. When I generated a digital signal of steadily decreasing amplitude with my Audio Precision test equipment, results were even more spectacular (Fig. 4). I could detect no deviation from perfect linearity down to –110 dB; even at 120 dB below maximum record level, deviation amounts to less than 3 dB.

As in my first test of a DCC recorder (January 1993 issue), I wanted to evaluate the effects of the DCC format's bit-rate reduction system (PASC) on complex signals that contain a rich mixture of harmonics. Therefore, I again used a 700-Hz sawtooth waveform to evaluate the effects of PASC. Spectrum analysis (not shown) revealed that while the input signal contained a mixture of high-order odd and even harmonics past 23 kHz, the even harmonics in the playback signal had far lower amplitude, and there were no harmonics above about 15 kHz. This is because the PASC algorithm determined that these harmonics would fall below the hearing or the masking threshold that is used in determining which signal data need not be recorded. I also noted that the noise floor over the range from 20 Hz to 15 kHz was higher in the playback version of the signal than it was in the original input signal.

I'M A BELIEVER: DCC RECORDINGS CAN BE EVEN FREER OF NOISE AND DISTORTION THAN 16-BIT LINEAR CDs!

The reason I'm not presenting the sawtooth-wave spectra is that a new Philips test CD, *Audio Signals Disc 1* (SBC429), contains an even more useful signal for this type of analysis. This signal consists of a train of single, maximum-amplitude positive-pulse samples, spaced 69 samples apart. The precise repetition frequency is 630 Hz. As revealed in the spectrum analysis of Fig. 5A, this signal generates a series of equal-amplitude harmonics over the entire audio range, each separated from its adjacent harmonic by the 630-Hz repetition frequency. Anyone familiar with the principle of low-bit-rate encoding will appreciate that the DCC PASC encoding system would have a difficult time trying to reproduce *all* of these harmonics. Such was the case when I played back a DCC recording of this test signal, as shown in Fig. 5B. Although the peaks of the signal's harmonic components are all there, the noise floor over much of the spectrum has been raised by about 40 dB! Happily, most music does not subject the DCC system to this kind of signal degradation, as became obvious during my listening tests.

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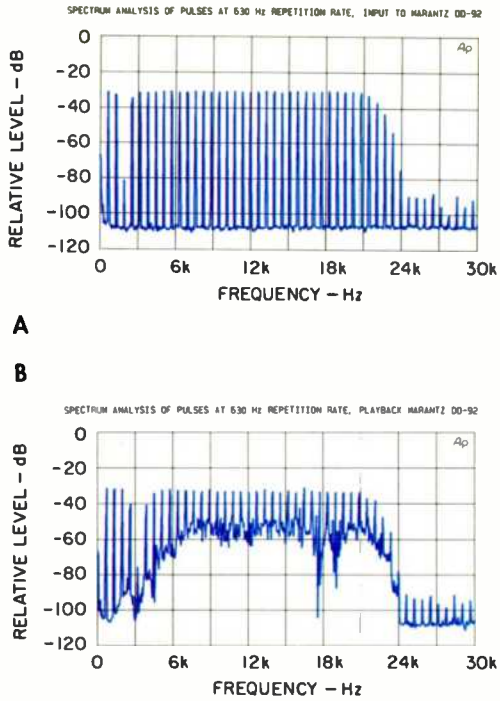

Fig. 5—Spectrum analyses of repeated pulse signal (A) and of signal recorded and played back (B); see text.

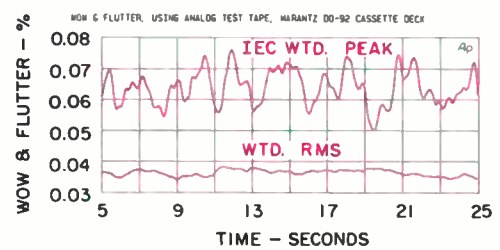

Fig. 6—Wow and flutter.

Before conducting the listening tests, I wanted to check out one more aspect of the DD-92, wow and flutter when playing back standard analog cassettes (Fig. 6). Wow and flutter was measured two ways, the first using the accepted wtd. rms method and then using the peak weighted method endorsed by the IEC. Weighted rms wow and flutter is around 0.035%, exactly as specified, and even the IEC-weighted measurement is basically below 0.07%. In the digital mode, wow and flutter was below measurable limits, as Marantz correctly stated.

Use and Listening Tests

I can't wait to get my hands on more DCC software. At the moment, I have only about five prerecorded DCCs, and only one of these contains classical music (which I find much more suitable for subjective listening tests than pop or rock material). So, once again I trotted out my precious DCC version of Mahler's First Symphony (London 425-718-5) and listened to all four movements, first on a pair of high-quality headphones (I hoped to detect flaws inherent in the bit-rate reduction system) and then through my reference stereo system terminating in KEF 105.2 speakers.

Although I tried to conduct some comparison tests between a CD version and the DCC version of Mahler's First Symphony, I must confess that true comparisons were not possible since the two performances are by different orchestras and conductors. What I can say, without qualification, is that the DCC was every bit as "musical" and enjoyable as the CD, despite some differences in tempo and interpretation. As far as I could detect, the bit-rate reduction system used in DCC did not in any way degrade the performance, nor did I hear any noise or distortion anomalies in the reproduced music, notwithstanding the elevated noise levels noted in my bench tests when I used complex test tones.

The originators of the Digital Compact Cassette format have done their psychoacoustic homework very well indeed, and the engineers at Marantz have outdone themselves in making the most of the DCC format. I frankly was skeptical when I was told that, using 18-bit A/D conversion, it might be possible to produce DCC recordings that were even freer from noise and distortion than 16-bit linear CD recordings. After extensive experimentation with the Marantz DD-92, I have abandoned my skepticism and become a believer!

Leonard Feldman