5

POSTSCRIPT: SONY CDP-101 DIGITAL AUDIO DISC PLAYER

Manufacturer's Specifications*
Frequency Response: 5 Hz to 20 kHz, ±0.5 dB.
S/N Ratio: Greater than 90 dB.
Channel Separation: Greater than 90 dB at 1 kHz.
Harmonic Distortion: 0.004% at 1 kHz.

Company Address: Sony Dr., Park Ridge, N.J. 07656.
For literature, circle No. 94

* For complete list of specifications, see November 1982 issue, page 43.

Here is a "better-late-than-never" effort to quantify the performance of the remarkable Sony CDP-101 DAD player which I tested for the November 1982 issue of *Audio*. If you read that report, you will recall that right up to press time I had hoped to have a definitive test record with which to measure the performance of the new digital disc player in an objective manner. At last, the people at Sony (co-inventors with Philips of the Compact Digital Disc player system) came up with the first such disc that I know of and loaned me a copy. And of course, that gave me a good excuse to borrow back the DAD player, along with a couple of new Compact Digital Discs I hadn't auditioned before.

Contents of the Test Disc

The Sony Test Disc (catalog number YEDS 2) is entitled "Test C.D. Type 1 for Signal Performance Check." It con-

tains a total of 39 separate bands or test signals and, like all digital discs, also has an encoded "Table of Contents" listing the number and length of these selections.

Band 1 is a 1-kHz, reference-level signal recorded at 0 dB level on both channels. (Recall that "0 dB" in this digital disc system is the highest recordable level available.) Unlike analog tape or disc recording, there is no available headroom beyond 0 dB.

Bands 2 through 11 contain spot frequencies of 100 Hz, 200 Hz, 500 Hz, 1 kHz, 5 kHz, 7 kHz, 10 kHz, 16 kHz, 18 kHz and 20 kHz, all recorded at the same 0 dB level and on both channels. These bands are used to check playback frequency response, THD versus frequency, and the presence of any modulation noise.

Bands 12 through 20 contain 1-kHz test signals on both channels, recorded at progressively lower and lower signal levels, beginning at 0 dB and followed by levels of −1, −3, −6, −10, −20, −60, −80, and −90 dB. These signals are used to check linearity of the player as well as THD versus level.

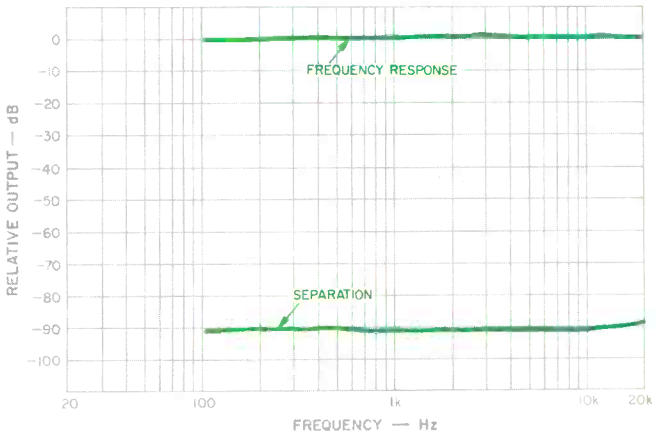
Band 2 is the digital equivalent of a "silent groove" analog recording and is used to check the player's signal-to-noise ratio.

Bands 22 and 23 contain a two-tone, SMPTE-type IM test signal (400 Hz and 7 kHz in a 4:1 ratio) at levels of 0 and −10 dB, while Bands 24 and 25 contain 19 and 20 kHz twin tones recorded at 0 and −10 dB levels.

Bands 26 through 33 contain frequencies of 100 Hz, 1 kHz, 10 kHz and 20 kHz at 0 dB level, recorded first on the left channel and then on the right. These signals are used to measure the system's channel separation capability. Bands 34 and 35 contain square-wave signals at 100 Hz and 1 kHz for transient response measurement.

The standards developed for the Compact Digital Disc incorporate pre-emphasis and de-emphasis characteristics involving time constants of 50 and 15 μS. To test whether players have correct de-emphasis characteristics, bands 36 through 38 contain test frequencies of 1, 5, and 16 kHz, recorded so that during playback they should reproduce levels of −0.37, −4.53, and −9.04 dB respectively.

Fig. 1—Frequency response and separation.



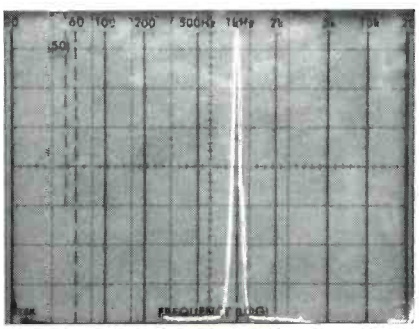
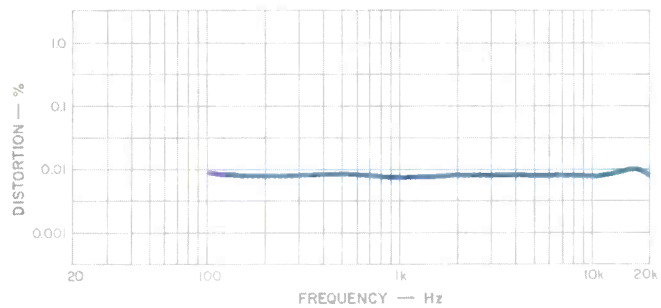


Fig. 2—THD for a 1-kHz test tone at 0 dB level was too low to be measured on a spectrum analyzer with a range of 80 dB. There was also no evidence of modulation noise on the Sony CDP-101.

Fig. 3—Distortion vs. frequency.



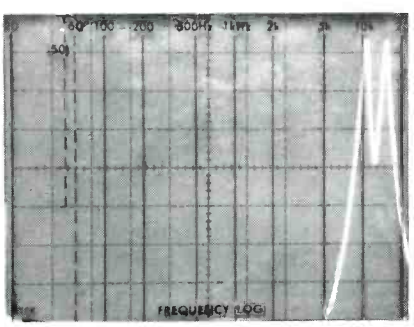


Fig. 4—Twin-tone IM test signal was reproduced with no evidence of modulation products within the audio range.

"There is no evidence of modulation noise or harmonic distortion within the analyzer's range."

Finally, band 39 of the test record concludes with an extended 1-kHz reference test tone, again recorded at 0 dB level. This last tone runs for a full 14 minutes and 56 seconds, providing ample time for anyone to run through other desired single-tone, mid-frequency testing. All of the other bands give even the slowest moving lab tester plenty of time in which to make measurements. Bands 1 through 11 run for 1 minute and 56 seconds each; bands 12 through 38 run for 56 seconds each. Total recorded time on the Sony test disc is 61 minutes and 24 seconds—and all of that on one side of a disc which measures only 4¾ inches in diameter!

Measurements

Figure 1 is a point-by-point plot of playback frequency response (upper curve) and channel separation for the Sony CDP-101 player. Since the lowest test frequency on the test disc was 100 Hz, it was not possible to plot response or separation below that point. Having listened to a good deal of program material in my earlier tests and again in this re-test, I have no reason to suspect that response or separation would deteriorate in any way at still lower bass frequencies.

As for the separation plot shown, it should be more accurately described as a residual noise plot, since I saw no evidence of the discrete spot test frequencies on the 'scope when making these measurements. The readings of −90 dB or better really consisted of residual noise from the analog electronic circuitry of the player and whatever minute amounts of quantization noise might have been generated by the digital playback circuitry itself.

In an attempt to see if any modulation noise could be detected when playing back a steady tone, I fed the output of the player to a spectrum analyzer while playing the 1-kHz reference-level signal on the test disc. Results are shown in the spectrum analyzer 'scope photo of Fig. 2. There is no evidence of modulation noise or of harmonic distortion with the analyzer's 80 dB of dynamic range (−80 dB translates to a percentage of 0.01%).

Figure 3 is a plot of harmonic distortion versus frequency for as many test frequencies as were provided on the Sony test disc. Total harmonic distortion remained consistently below 0.01% for the 0 dB level at which these test signals were recorded. Recognizing that THD of a digital recorded signal tends to *rise* rather than fall at lower signal levels, I also measured the THD for a 1-kHz signal at levels of −10 and −20 dB. As expected, THD did rise somewhat, to an insignificant 0.01% at −10 dB record level and to −0.025% at −20 dB. Linearity remained accurate within 0.1 dB all the way from 0 dB record level down to −80 dB!

SMPTE IM followed much the same pattern as THD. At 0 dB record level, I measured an IM of 0.0075%, while at a −10 dB level, the IM number increased to 0.02%. At this point I think I should remind you that we're talking about a disc recording and player, and not an amplifier or preamplifier!

I went through the motions of plotting twin-tone IM on the spectrum analyzer, from 20 Hz to 20 kHz. As shown in Fig. 4, no IM products showed up across the sweep. Only the two test tones themselves are evident at the right-hand side of the screen.

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Signal-to-noise measured 91.0 dB, unweighted, increasing to 95.5 dB when an A-weighting network was inserted in the measurement path. De-emphasis was accurate to within 0.1 dB (I measured −9.1 dB at 10 kHz, as against a specified −9.04 dB, for example), but who's to say whether my dB meter is more accurate than Sony's test disc and/or player when we're splitting such hairs?

It's always nice to get lab confirmation of what our ears tell us. In this case, the delayed arrival of the Sony test disc served a good purpose for this reviewer. The enthusiasm that I expressed in the November issue for the Sony CDP-101 player and for digital audio discs in general has not been contradicted in any way by the lab test measurements. It's nice to know that my hearing is still reasonably acute!

Leonard Feldman