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No. 47

HI-FI CHOICE

CASSETTE DECKS & TAPES 1986/87

BY NOEL KEYWOOD

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INTRODUCTION

My editorial policy on *Choice* has always been to get personally involved in a review project, to the extent of keeping an ear on what the reviewer is up to and checking out how the particular market is evolving, even though I may have little direct experience of the product category being reviewed. Such was the case with *Cassette Decks And Tapes*, yet getting back into the medium for the first time in five years has been an instructive and enjoyable experience. I have ended up with a much healthier respect for the pre-recorded musicassette, a strong desire to acquire a Nakamichi CR-7, and the bill for a Sony *ProWalkman*, the latter a demon device to resuscitate my practice of recording live concerts. I have also come to appreciate just how practical and resilient the cassette medium is, to the extent that it seems unlikely to be made redundant by any new-fangled digital technology for many years to come — if ever.

The Compact Cassette is very much hi-fi's 'bastard' medium, at least on ethical grounds. But there is no disputing its success, its convenience, or the high standards of sound quality that can be achieved nowadays — at its best, fully comparable with CD or LP disc. The unique feature of the medium is, of course, the ability to record. But it should also be stressed that musicassettes are a major source of pre-recorded music, now outselling LPs (though lagging well behind vinyl when singles are added into the equation). Versatility and compactness are the twin pillars of the cassette's success. All audio systems have begun in the home, but the cassette has done for the music industry what the transistor did for radio, providing 'go anywhere' flexibility in portables, personals and in-car variations.

The most obvious recent trend in domestic mains machines has been towards the double 'dubbing' deck, fitted with two transport mechanisms. *Choice* has tended to steer clear of these, less for moral reasons, discussed shortly,

than because there is no way such a machine can out-perform a single transport machine at a similar price. However, the market share of dubbers continues to increase, so we have included a number of new examples this time around, though by and large, they have done little to change our opinions significantly. However, those who do want this extra facility can now decide for themselves whether the price penalty is worthwhile, and at least one manufacturer has shown that high quality dubbing decks can exist, albeit at a price

MORALITY & HYPOCRISY

Happy enough to sell ever increasing quantities of pre-recorded tapes for all applications, particularly back-catalogue re-issue compilation material, the music industry still cannot come to terms with the fact that many people use their cassette machines to record friends' LPs on blank tape, or to record music programmes from the radio, so by-passing the significant copyright element in the price of pre-recorded material. The appearance a few years ago of 'dubbing decks' containing twin mechanisms for copying tape-to-tape (in some instances at high speed), or for making two copies simultaneously, was greeted by hysteria which extended to the High Court, as paranoid record company representatives envisioned large scale tape counterfeiting spreading to suburbia.

Yet the dubbing deck only provides a convenient package which extends to musicassettes an existing inherent capability to 'steal' from LP, CD or radio. And much as one might sympathise with the rectitude of the music business' attacks on copyright theft, their case is riddled with hypocrisy and undermined by ostrich-like stupidity. Originally the individual enthusiast, harmlessly recording his favourite band from a seat in the concert hall on a nasty little recorder, was singled out as the villain of the piece — the dreaded 'record pirate.' Yet such a fanatic would almost certainly own every recording of the band that the record company could be

ment of heads and electronics. Although international tape equalisation and noise reduction standards do exist, not all manufacturers are equally good at adhering to them. The result is that many decks perform less well on replay only than they do within the 'closed loop' of record/replay, and our reviews pay close attention to this.

RECORD/REPLAY

In some ways record/replay is easier than replay only, insofar as head alignment, Dolby tracking and equalisation errors can cancel out and compensate for each other. However, any inherent transport problems are likely to be exaggerated, and there is now a still greater premium on the quality of the record head, particularly if metal tape is likely to be used. To get a decent quality recording, a deck needs to be accurately aligned electronically for a sensible range of different tape types; some machines offer variable bias for 'fine tuning' to specific tapes — a useful facility for those prepared to take the

trouble.

Ergonomics play a part in realising the full performance potential of a deck. Automatic tape type selection can help prevent a silly mistake from spoiling an important recording — and the sort of two-button interactive combination switching used for tape selection on many budget decks could have been especially designed to mislead the unwary or hasty. Good quality metering set to the right sensitivity level can be a boon, though in time and with practice a cassette deck owner will probably gradually come to learn the 'right' meter level for getting most signal without compression onto a specific type of tape.

It is worth carrying out a few practice runs to explore the limits of the deck with a particular tape. Try increasing the record level by a specific amount at specific counter intervals during recording, then back off the volume setting at the same time intervals during replay so that the overall sound output remains reasonably constant. You should then be able to hear

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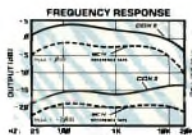
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bothered to release, and would end up with material the quality and commercial value of a home movie. At the same time thousands of hi-fi enthusiasts became utterly disillusioned by the appalling quality of early musicassettes, which were manufactured using the lowest grade tapes and the cheapest most jam-prone mechanisms. Tapes made at home using reasonable quality domestic equipment sounded much better, so why pay a premium price for a second-rate product?

Happily, recent years have seen big improvements in the quality of the best duplicated musicassettes (though there is still plenty of room for improvement across the board). And the real 'pirates' have been correctly identified as the counterfeiters of Singapore and elsewhere, not to mention the street-merchants of every capital city who ask few questions about the origins or quality of low cost product. Yet unfortunately there is no easy way to prevent or compensate for individual 'piracy' without penalising the many people who justifiably make

copies of LPs, CDs, or musicassettes which they have already purchased, for use in the car, in portables, second room systems etc.

REPLAY

Nowdays the best musicassettes can give very respectable quality, so pre-recorded material certainly deserves to be taken seriously, and the replay-only performance of a cassette deck must be considered a crucial element. Theoretically, pre-recorded cassettes could be as good as or even better than those made on all but the very best domestic decks, as the equipment for mass duplication ought to be superior mechanically and electronically. However, in practice quality and quantity often conflict, and the profits are created by the latter. Nevertheless the end result is often good enough to show up limitations in even the very best cassette decks, so the ability to get the best from musicassettes is a valid assessment for a cassette deck.

The task requires a good quality tape transport mechanism and replay head, plus careful align-

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the sound balance and/or distortion start to change as either machine or tape reaches overload, and so deduce the right peak meter levels to use for the best balance between background noise and recording quality. It may also be worth trying a similar subjective run through with and without noise reduction circuitry, as some listeners prefer an unprocessed if noisier sound, and noise reduction circuits are not always properly adjusted for different tape sensitivities.

TAPE TAPES

A full comparative analysis of different brands and types of tape will be found in the *Cassette Tapes* section. Though there are three formal groups of tapes, Types I, II and IV, there are sub-groups within each group which further confuse. In brief, the best advice is to find a tape in each group which suits the set-up of the recorder, and then stick to it. (But note that the tape manufacturers have an annoying habit of re-mixing formulations regularly without changing the brands.)

The very cheap ferric tapes are not hi-fi quality, so it is better to go for premium Type I ferric from a reputable brand for general purpose use. A Type II chrome or pseudochrome will give a step-up in quality, while Type IV metals can turn out to be the cat's whiskers on some decks — but may not work too convincingly on others. Perversely, the very best decks can produce stunning results on the better quality Type I ferrics.

FEATURES

No other component fulfills a button pusher's dream like a cassette deck. The bare essentials boil down to tape selection (which can be automatic), and Dolby B noise reduction (necessary for musicassette replay but optional for record/replay).

A host of imaginative inessentials will either enhance the enjoyment or baffle the user, depending upon temperament. Microphone inputs

are fast disappearing, with better quality microphones commonly containing battery pre-amps to provide a line-level signal for normal deck or amplifier connection, but headphone sockets remain. Extra noise reduction may be Dolby C and dbx, with headroom extension from Dolby HXPro. Electronic logic control may supervise an almost silent transport system, giving the potential for microprocessor-controlled track search and programming systems; for auto-reverse to extend play or record times; and for automatic tape tuning in the more expensive machinery. Bias 'tweaking' enhances tape matching, while replay EQ may be trimmed for optimum replay response on some machines. The manufacturer can choose to spend money on a better quality single transport, with a closed-loop double-capstan system perhaps, or slot in a second dubbing transport with all the attendant extra complexity.

Styling is clearly a matter of personal taste, but the whole gamut exists from the garish clash of multicoloured illuminated displays shouting 'buy me' off the shop shelf, through to the deliberately understated or the daringly unconventional. Ergonomics vary from the crass and confusing to the subtle and effective, though take heart from the fact that a purchaser will soon learn to use his own particular deck, as he would learn to drive a new car.

Having weighed up the pros and cons of your own priorities and requirements, and having studied our reviews, it's not a bad idea to audition one or two likely contenders. A comparison with something really good is almost essential to establish a quality yardstick when trying to assess how much you will need to spend to achieve the desired level of performance. The enthusiast may not take the purchase of a cassette deck as seriously as he would the selection, of turntable, arm and cartridge, but audible differences between cassette machines are no less obvious.

Paul Messenger

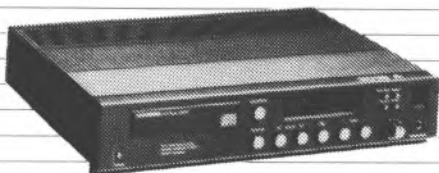
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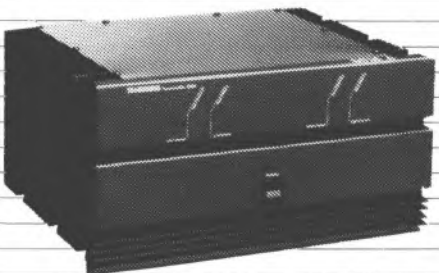
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CASSETTE DECK BUYER'S CHECKLIST

Some decks don't have microphone inputs at all. Quality with regards to noise and distortion can be surprisingly poor. Microphones of the appropriate output and impedance should be used, or powered high quality mikes through the amplifier.

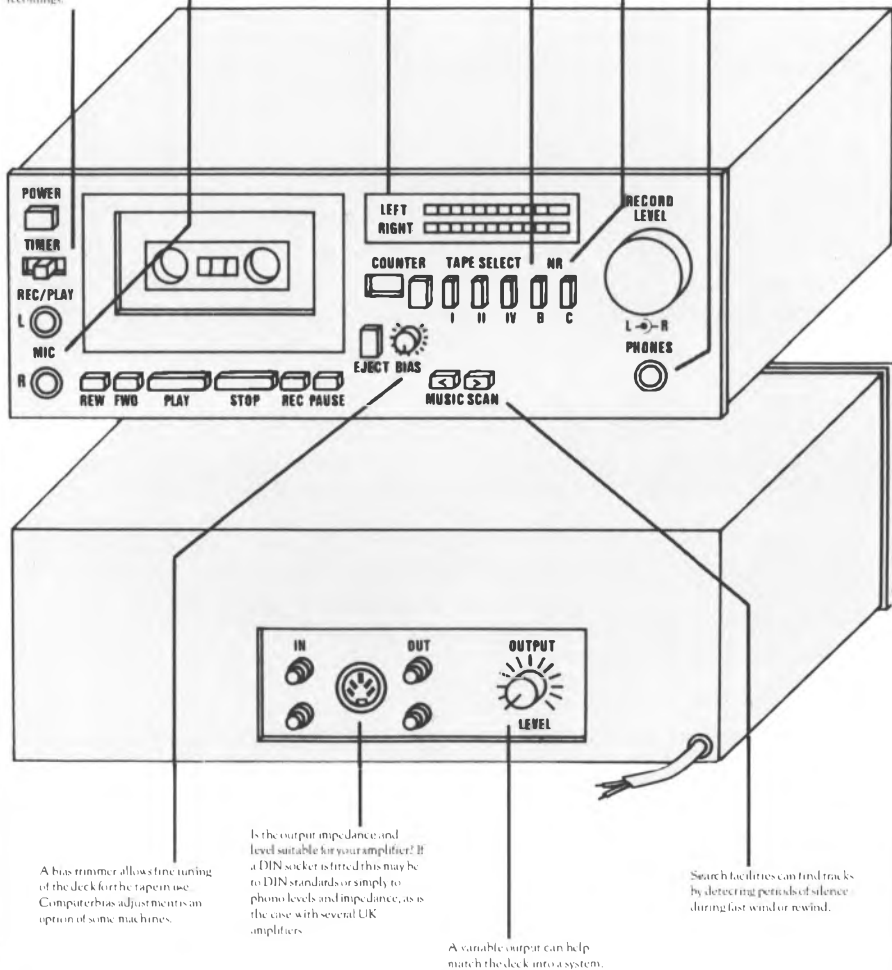
Do the meters respond fast enough to be called peak meters? Are they suitably calibrated to enable you to use the maximum head-on available on peaks without distortion, or will you lose signal in the tape noise floor through overloading?

Various noise reduction systems may be fitted.

Some decks are not able to drive less sensitive headphones to even acceptable levels and a check should be made for compatibility. A level control is useful; sometimes a line output level control also controls headphone level.

The machine must have a Timer switch to make unattended recordings.

If not automatic, tape selection can be confusing; a status display can help avoid errors.



A bias trimmer allows fine tuning of the deck for the tapes you use. Compatible bias adjustments are an option on some machines.

Is the output impedance and level suitable for your amplifier? If a DIN socket is fitted this may be to DIN standards or simply to phono levels and impedance, as is the case with several UK amplifiers.

A variable output can help match the deck into a system.

Search facilities can find tracks by detecting periods of silence during fast wind or rewind.

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CASSETTE DECKS: TECHNICAL INTRODUCTION

Cassette decks are used both to play pre-recorded tapes, and to record tapes for use in personal stereos, car stereos and of course in the recorder itself at home. We have kept these considerations very much in mind in this book. All the cassette decks were treated as:

REPLAY DEVICES — tested for their ability to reproduce musicassettes well.

RECORDING DEVICES — tested for their ability to provide high quality recordings.

The distinction may seem unimportant at first sight, but it is not. Although recording appears to be a more complex function than replaying pre-recorded musicassettes, the reverse is in fact the case.

REPLAY PERFORMANCE REPLAY FREQUENCY RESPONSE

The purpose of cassette replay standards is to ensure perfect compatibility. Pre-recorded tapes bought in the shops must run at the correct speed 4.75cms/sec (the metric equivalent of the old $1\frac{7}{8}$ inches/sec). The recording equipment used to make them must have the same frequency response as the decks used to replay them, so they sound tonally correct — and so on.

In this book standards reign virtually supreme: they have been taken as the commandments to which manufacturers must work, even when it is known that they are not perfect. I personally have little sympathy for those manufacturers who choose to ignore or 'interpret' standards to suit their own ends, as this sort of thing defeats the whole purpose of having standards. At the same time where a whole body of manufacturers have ignored a standard — like that for chrome tape sensitivity, for example — the outcome cannot be ignored, and conclusions have taken this into account.

It has taken nearly 20 years of cassette development for a proper test tape to be made which defines the replay frequency response of

cassette decks. At a meeting in Prague during 1981 the IEC (International Electrotechnical Commission) agreed to issue a new revised replay response standard. The BASF Calibration Tape (ferric, 120 μ S) was used to test for agreement to this standard, and the results are shown in the replay response graphs. Small response errors are always exaggerated by Dolby B, so they should not be ignored.

Most decks have falling replay frequency response, due to the use of misleadingly inaccurate 'transfer standard' test tapes made in Japan. Azimuth error can also produce falling treble, but usually shows a sudden and rapid fall in extreme treble, rather than the slow fall above 800Hz that many of our replay graphs show.

Listening tests involving a wide variety of pre-recorded cassettes (which are of very variable quality) were carried out on all decks, to compare replay sound quality with a Nakamichi CR-7 reference. Falling treble, magnified by Dolby B action at low levels, often resulted in a dull, boring sound lacking 'attack' and definition. Happily this year many more decks came closer to following the BASF 'official' IEC test tape, and consequently sounded much livelier.

Replay frequency response is quoted within ± 2 dB limits, though ± 1 dB limits up to 10kHz at least is to be preferred. This requirement is not impractical and some manufacturers obviously try hard to meet it, Nakamichi and Aiwa being two examples.

REPLAY SPEED STABILITY

Speed variations in the transport mechanism of a cassette deck significantly affect the fidelity of pre-recorded cassettes. Although musicassettes sometimes have poor inherent pitch stability and suffer wow themselves, the additional wow and flutter introduced by a mediocre transport mechanism audibly detracts from quality. Listening tests consistently showed that decks with audibly poor speed stability when recording showed like effects with pre-recorded



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tapes, to a sometimes disconcerting degree. Both replay speed accuracy and stability (drift, wow and flutter) were tested using a BASF 3150Hz test tape. Auto-reverse decks were checked in both directions of play.

REPLAY NOISE

Noise in the replay amplifiers of cassette decks is now only just below the independent noise of the latest super-quiet tapes (TDK SA-X, SA and BASF CR-III, CR-EII). Hum can be a problem too. Both hiss and hum were measured on a noise meter (CCIR, etc) and a spectrum analyser, with a tape-less dummy cassette in the machine. The quoted hiss value is for 70 μ S replay EQ, Dolby out. A figure of -60dB or better should be achieved.

RECORDING PERFORMANCE FREQUENCY RESPONSE IEC PRIMARY REFERENCE TAPES

The IEC Primary Reference Tapes were used to measure the record/replay frequency response of all the decks tested in this book, results being shown in the response graphs. The IEC *Type I* reference ferric tape is made by BASF, the IEC *Type II* reference chrome tape is again made by BASF, while the IEC *Type IV* reference metal tape is made by TDK.

There are a number of benefits from using these tapes. They are broadly accepted as a working standard, so cassette decks should give a flat frequency response with them. In other words, the graphs should show a reasonably flat line from around 100Hz up to at least 10kHz, within a few dB. Frequency response in the performance tables are quoted with limits of 2dB. This flat frequency response means that recordings will possess even tonal balance. If the trace rises at high frequencies, treble output will be excessive, and recordings will sound bright or even shrill. Conversely, falling high frequencies will give recordings which sound dull, muffled and enclosed. All response errors are magnified by using Dolby noise reduction.

Where cassette decks show a flat frequency response with IEC Tapes, they will match IEC-aligned 'standard' blank cassette tapes well, because most tape manufacturers now ensure that they have at least one high quality IEC-like tape in each category. The Maxell *UD-I* and

UD-II tapes provide a good example because the tapes were tested relative to these IEC primary reference tapes, their own frequency responses indicate their performance with the decks. By using IEC reference tapes, the test results are directly comparable and therefore meaningful.

SPEED STABILITY

Tape should pass over the heads at a constant speed of 4.75cms/sec. It is pulled past by a rotating metal rod known as the capstan, against which it is held by the pinch wheel. If the capstan is bent or not perfectly round, the tape will speed up and slow down slightly, at roughly six times per second (because capstans complete approximately six revolutions every second, ie they turn at 6Hz). Frequency is increasing and decreasing at this rate, so the signal is being frequency modulated.

Frequency modulation is a quite complex effect, producing multiple sidebands that in theory fade out at infinity (unlike amplitude modulation sidebands that are finite). In practice, 6Hz modulation results in significant 6Hz sidebands either side of all signals, and examples can be clearly identified as spikes either side of the single test tone spike, at right, in many of the spectral analyses.

Just one total DIN-weighted wow and flutter test results figure is quoted for the sake of simplicity. This gives some indication of goodness, but the test procedure for every machine included gathering two spectral analyses, separate wow, flutter and drift figures, plus various listening tests, in order to assess fully the speed stability performance.

Speed variations have the following subjective effects:

LOW RATE DRIFT & WOW, (below 2Hz).
This produces pitch 'meandering'. Music never quite seems to know what it is doing pitchwise and sounds 'uncertain'.

MEDIUM RATE WOW, (2Hz — 4Hz).
This often has a random nature and adds pitch 'shakiness' to notes. Sometimes piano can sound 'jelly-like', as if the notes are wobbling.

HIGH RATE WOW, (4Hz — 10Hz).
This is where capstan irregularity usually comes into the picture. It is regular and adds a nasty 'warbling' effect to notes.

LOW RATE FLUTTER, (10Hz — 15Hz). ▶

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◀ This is heard as a fast warble or flutter on notes. Pitch may seem stable, but the essential character is altered or 'dirtied'.

FLUTTER (above 15Hz).

High rate flutter produces 'diffuse' sounding notes and adds harshness and 'muck' into a performance. Dirty, diffuse-sounding cymbals that 'schhhh' are due to high levels of high rate flutter.

Flutter sidebands are often far removed from the main exciting signal and are heard as a separate effect, not as an inherent part of that signal, which distinguishes them from wow. The measured amount of energy distributed into flutter sidebands was measured, over a region stretching from 3kHz to 3.13kHz. The equivalent band level value, relative to Dolby flux, is quoted as a -dB value, in the test results.

MODULATION NOISE

Modulation noise is random AM and FM modulation, resulting from jerky tape motion at a microscopically small level and very high rate, caused by tape surface, head and guide roughness. The modulation noise of every recorder was measured using BASF CR-EII — a low mod noise tape. Band energy was measured from 3000Hz to 3130Hz, relative to a 3150Hz stimulating test tone recorded at Dolby flux.

TAPE HISS AND DISTORTION

There may be less mention than usual of hiss and distortion in the reviews, largely because there is little that can be done about either in the face of tape limitations, apart from using Dolby B or the newer Dolby C noise reduction system to reduce hiss. Hiss was measured relative to Dolby flux, using BASF CR-EII tape.

If one records to high levels in order to minimise hiss, distortion occurs as treble confusion or general muddle. Keeping the level down avoids distortion, but then hiss may be heard. The trick is to get the correct level so that neither prevail.

Most cassette recorders now have their record level 0VU point set to Dolby level. (This is a convenient tape flux reference level of 200nWb/m, as distinct from the IEC reference level of 250nWb/m). Today's LED record-level displays read peaks accurately, so average recording levels are sensibly kept down to a point

where severe treble overload does not occur with ferric or chrome tapes. Dolby C also helps prevent severe treble overload, due to its mild peak-companding action.

Distortion should generally be low if 0VU is not exceeded when recording. 0VU distortion on metal tape (TDK MA-X) was measured at low frequencies (40Hz) (to assess head saturation), in the midband (300Hz), and at high frequencies (3kHz). The balance between midrange and treble distortion is substantially determined by bias adjustment. If bias is high midband distortion will be low but treble distortion high, and *vice-versa*. Distortion is quoted as a single figure to avoid confusion, this being an average of the three results.

MOLs and SATs

MOL is short for Maximum Output Level and is best thought of as the midband (300Hz) overload ceiling of a tape or cassette deck. The figure quoted for each type in the test results refers to the IEC reference tapes, specifically the signal level that is within a 3% distortion limit referred to IEC 0dB level (250nWb/m flux).

The metal tape MOL is always interesting. This is a really tough test, because bias and signal levels are both very high. Many decks, especially budget models give worse results with metal tape than ferrics.

SAT is short for Saturation, which is the high frequency (10kHz) overload limit of a deck, again with the IEC reference tapes.

There is a direct compromise between MOL and SAT, both of which are determined by bias. If bias is set high, a good MOL figure can be obtained, at the expense of saturation level, and *vice-versa*. Where a good head is used, both MOL and SAT will be high.

Since the IEC 0dB level is roughly 2dB higher than the Dolby flux level which is the 0VU point on a good many recorders, adding 2dB to the MOL and SAT results will give a rough guide to the maximum recording level that can be achieved on a deck. High MOLs and SATs give a recorder plenty of 'headroom', allowing high recording levels to be used and so making hiss less obvious. In effect, dynamic range is expanded, especially when premium grade low hiss tapes are used.

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Aiwa have a distinctive style exemplified by placing the transport controls and some facilities on a ledge beneath the fascia. The transport is logic-controlled and will accept most unusual commands, except 'punch-in' record. A cue/review system allows signal monitoring whilst fast reeling. The mechanics respond quickly to commands and work smoothly enough if noisily.

Tape selection is automatic — something often lacking from more expensive machinery — and backed up by clear status display. Dolby B and C are operated by a sliding switch, again with an LED display. Fine bias adjustment matches tapes and machine prior to recording, but unfortunately this facility only operates for ferric and chrome tapes, metal being preset. A sliding record level control has an independent balance adjuster, and the LED peak level meter has a broad -20 to $+10$ range, but with mediocre resolution.

LAB REPORT

Like previously tested Aiwas, the AD-F360 possessed a flat replay frequency response. This makes it virtually unique amongst brands, only Nakamichi consistently achieving a similar result. One can therefore assume that the AD-F360 will handle musicassettes well. Replay

speed was correct and both hiss and hum in the replay amps adequately low.

The speed stability characteristic was curious; capstan wow was low but random speed drift higher than usual, producing very low rate wow. There was very little synchronous flutter, but a fair bit of random scrape flutter out at high frequencies. Consequently, modulation noise measured high at -36 dB, compared with a typical result of -40 dB for a single capstan machine. Flutter band-energy was a low -30 dB. This unusual set of conditions is likely to result in diffuse pitch, but not obvious wow ('drunkenness'). There should be little coarseness too, but some possible loss of 'see through' clarity. Aiwa never skimp on head quality, but often set bias lower than other manufacturers to improve treble quality. This is at the expense of some midrange headroom: chrome tape resulted in a rather poor overload ceiling (MOL 315Hz) of -2 dB; metal and ferric performed well. Frequency response with metal tape measured flat. The characteristic can be varied with chrome and ferric tape by adjusting bias, and tests showed just enough variation to accommodate awkward tapes like BASF CR-III and LH-XI.

SOUND QUALITY

Metal tape (Maxell MX) sounded clear and

open, with no sense of muddle at high levels. Strings sounded very smooth, transients were strong, and coarseness not apparent. In every respect, quality was very good. A piano recording revealed slightly vague or tremulous pitch, injecting a 'jelly-like' quality on occasion. There was no sign of obvious 'drunkenness' though, and tonal purity was excellent. Piano sounded pleasant, if not pitch-solid. Recordings on chrome tape (BASF CR-II) sounded surprisingly thick and murky, and generally unimpressive; low record level helped. Ferric tape (TDK AD) sounded 'enclosed' tinged by coarseness and with a 'jangly' quality.

Pre-recorded tapes sprang to life in a manner not even approached by most other decks except Nakamichi's. There was fine clarity, detailing, and imaging. Strong bass with good extension added dynamic weight and made music excitingly 'dimensional'. 'Problem' recordings became no problem. The AD-F360 was way ahead in reproducing pre-recorded tapes.

SUMMARY

Easy to operate and with good facilities, the AD-F360 produced fine recordings with metal tape, but was not so good with ferric and chrome. Pre-recorded tapes sounded astonishingly good compared with other competitive machines.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-16.0kHz very good
 Speed accuracy _____ +0.4% very good
 Noise _____ -61dB good

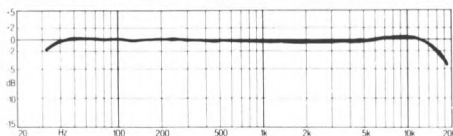
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-15.0kHz very good
 Frequency response, chrome _____ 27Hz-17.0kHz very good
 Frequency response, metal _____ 27Hz-16.0kHz very good
 Stereo separation _____ -46dB average
 Distortion _____ -1.0% good
 Noise _____ -53dB good
 Speed variation _____ 0.10% very good
 Modulation noise _____ -36dB poor
 Flutter energy (band level) _____ -30dB very good
 MCL, ferric, 315Hz/10kHz _____ +3.0dB/-6.0dB good
 MCL, chrome, 315Hz/10kHz _____ -2.0dB/-6.0dB very poor
 MCL, metal, 315Hz/10kHz _____ +3.0dB/+0.0dB average

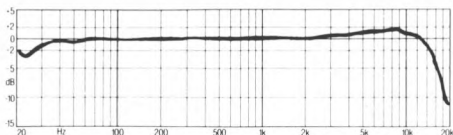
Input/output performance

Line in sensitivity/overload _____ 50mV/>3V
 Mic input sensitivity/overload _____ None
 Output level _____ 500mV
 Typical price inc VAT _____ £99

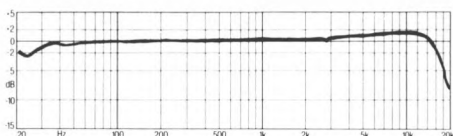
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



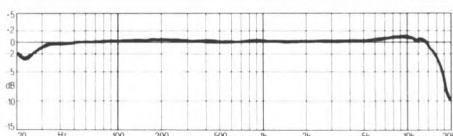
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

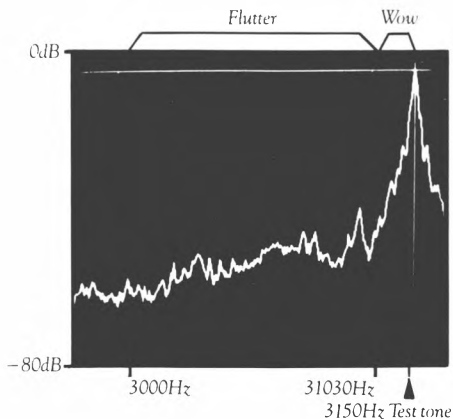


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



ENTER THE SONY/HI-FI CHOICE



Pictured above are Sony's CDP502ES CD player and TA-F444ESII amplifier, TC-K444ESII cassette deck, ST-S444ESII tuner and APM 22ES speakers — all five items comprise the top end of Sony's specially designed 'ES' Hi-Fi range, which can be won in a three part competition brought to you by Sony and *Hi-Fi Choice*. Parts one and two of the competition appeared in 'Compact Disc Players' (June) and in 'Speakers' (August). (See opposite page for the final 'Digital Ready' question Number Three).

Sony are following up their CD players with the introduction of a full range of separates called 'ES', of which the following models are offered as main prizes:—

- Sony CDP502ES — this sophisticated, integrated player offers superb sound and a host of features including a shuffle play and a fully programmable remote commander.
- Sony TA-F444ESII amplifier — combining solid performance with a high power output, featuring 120 watts RMS (6 ohms) and using linear crystal oxygen-free copper.
- Sony TC-K444ESII — a high performance cassette deck with three laseramorphous magnetic alloy head systems and two pairs of capstan shafts.
- Sony ST-S444ESII tuner — with high precision direct comparator technology allowing a comparison frequency of up to 50kHz, dual-gate MOS FET RF amplifier and ten pre-sets.
- Sony APM22ES loudspeakers — *Hi-Fi Choice* 'Recommended', specially designed to cope with digital audio sources, and featuring a two-way speaker system.

The above separates retail for approximately £1,700.

In this issue, *Hi-Fi Choice* is offering you the chance to win a first prize of Sony's TC-K444ESII top quality cassette deck (pictured right), specially equipped to produce superb and accurate sound reproduction, whilst a runner-up will receive Sony's TC-R502 cassette deck, which features the added benefit of auto-reverse operation. To win either of these cassette decks, answer the questions opposite, retaining the 'digital ready' question for the main prize. The first and second prize-winners will be decided by the tiebreaker.

To win the main prize of Sony's top-end ES separates, all you have to do is complete all of the digital ready questions and send them separately with your name and address to *Hi-Fi Choice*.

DIGITAL READY COMPETITION



DIGITAL READY QUESTIONS

1. What is the standard CD sampling rate? (A) 44.1kHz (B) 32kHz (C) 48kHz
2. The theoretical resolution of the 16-bit CD system is (A) 90dB (B) 96dB (C) 100dB
3. The full 16-bit system used for digital audio signal level allows discrimination over how many steps? (A) 2^{16} (B) 16^2 (C) factorial 16.

'ES' CASSETTE DECK ENTRY FORM *Choose A, B or C*

- 1 Which of the reviewed Sony cassette machines offered variable replay speed? (A) Pro Walkman (B) TC-R502ES (C) TCK444ESII.
- 2 Which of the reviewed Sony cassette machines gave the best replay noise performance? (A) Pro Walkman (B) TC-R502ES (C) TCK444ESII.
- 3 Blank skip is a particularly useful feature on (A) Dubbing decks (B) Auto-reverse decks (C) Dual capstan decks?

Sony 'ES' is a natural choice of high quality hi-fi, because _____

_____ (not more than 20 words)

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RULES

The competition is open to anyone except employees of Hi-Fi Choice (and subsidiary companies) and Sony. All entries must be submitted on the above entry form. No cash alternatives to the prizes shown will be offered. The publishers reserve the right to publish any entry submitted and entries become the property of Hi-Fi Choice. The winners will be notified by post. In the event of more than one correct entry, the winner will be decided by the 'Sony ES' tiebreaker above.

BEST BUY

AIWA ADR550

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Aiwa's auto-reverse AD-R550 has a black finish and possesses a colourful array of lights, legends and displays. It is distinguished by having Dolby HX-Pro headroom expansion in addition to the more usual Dolby B and C systems. HX-Pro is not a noise reduction system like Dolby B and C; instead it allows high frequencies to be recorded to higher maximum levels on tape, before overload occurs.

Tape types are automatically selected, which is a valuable feature. However, there's no manual over-ride so old metal tapes without sensing slots are incorrectly seen as chrome and cannot be recorded. A fine-tune bias control provides tape matching with ferric and chrome — always a very useful feature. As new tapes appear, the deck can be adjusted to suit them.

Tape position is indicated by a four-digit fluorescent tape counter and a music search facility is included. Unfortunately, the tape counter reverts to zero when the machine is turned off and on again. The auto-reverse system can be set to allow once-only or continuous play or record of one side of the tape followed by the other.

Record level is adjusted with a horizontal stereo fader with a separate balance control above it. Meters are fluorescent bargraph types

of -20dB to 8dB range and reasonable resolution. Tests showed they gave accurate readings of peak levels on transients.

A rear-lit cassette compartment allows the position of the tape to be seen easily. Our only reservation concerning styling was that it is necessary to operate the deck from above because the tape transport controls were situated on the protruding platform, which itself is given to collecting dust. The deck felt solidly built and operated quietly and smoothly.

LAB REPORT

Aiwa have set peak record level (OVU) to -3dB below Dolby, which is too low for modern tape and peak-read meters. This results in higher tape hiss but low distortion. Our test results bear this out, with hiss around -66dB and average distortion at 0.7%. Other tests showed that the deck is inherently no noisier than usual and that bias has been set sensibly to give balanced maximum output levels at middle and high frequencies. However, Dolby HX-Pro gave less treble improvement on this deck than it did on the AD-F990.

All record sensitivities were 1dB out using IEC Primary Reference Tapes. Ferric and metal settings could usefully have been better in this respect. Dolby affected frequency response badly at low levels with IEC-type ferric tapes, producing a curve humped at 300Hz and falling treble

and bass either side. Low level musical passages will sound dull as a result. Results were much better with chrome and metal tapes, although slight treble lift will make high level program a bit bright. In spite of these observations though, all record/replay responses were considered good.

Replay frequency response, Dolby B tracking and speed accuracy were all well set, allowing this deck to give good fidelity with modern pre-recorded cassettes. Speed stability in the form of wow was good, but an equivalent level of -21dB (9% distortion) for flutter sidebands suggests audible muddle and was not impressive.

SOUND QUALITY

Metal tape gave a neutral tonal balance, apart from 'woofy' bass — probably caused by a subsonic peak on this deck. A degree of 'thinness' on saxophone and male voice was audible too. These effects were minor though. There was a sense of pitch 'diffusion' to sustained organ notes, due to low-rate speed variation (drift/wow). Additionally, some roughness was noticed due to flutter sidebands, which had an equivalent level of -21dB .

Using TDK SA chrome-bias tape, the AD-R550 sounded 'thin' and 'cold'. Treble roughness and splash on sibilants was again detected — probably due to flutter distortion (9%). Diffuse pitch was also evident. Increasing bias usefully resulted in a warmer sound. Ferric tape again had a 'woofy' bass quality and sounded dull at normal bias. This robbed music of a sense of articulation. Again, decreasing bias improved matters.

Replay quality was bright, detailed and open. Few decks veered in this direction, so we were pleasantly surprised. Tonal balance was a bit artificially forward, but this did result in an excellent sense of attack when playing pre-recorded cassettes. Imagery was good too.

SUMMARY

As auto-reverse cassette decks go, the AD-R550 has some substantial strengths. Dolby HX-Pro, variable bias for accurate tape matching and excellent replay performance combined to eclipse the performance of potential competitors.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response 20Hz-12kHz good
Speed accuracy +0.3% very good

Record/replay using blank tape

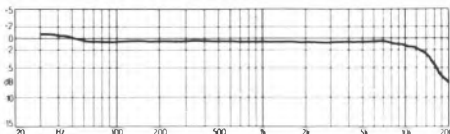
Frequency response, ferric 20Hz-15kHz very good
Frequency response, chrome 20Hz-17kHz very good
Frequency response, metal 20Hz-17kHz very good
Stereo separation -51dB good
Distortion -0.76% good
Tape hiss, ferric -65dB poor
Tape hiss, chrome -66dB average
Tape hiss, metal -66dB average
Speed variations (wow and flutter) 0.07% good
Modulation noise -39dB average
Flutter energy (band level) -24dB average
MOL, ferric, 315Hz/10kHz +4.5dB/-10dB average
MOL, chrome, 315Hz/10kHz +0.5dB/-7dB average
MOL, metal, 315Hz/10kHz +4.5dB/-0.5dB average

Input/output performance

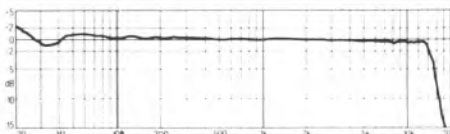
Line in sensitivity/overload 50mV/-V
Mic input sensitivity/overload 0.25mV/32mV
Output level 380mV
Typical price inc VAT £199

REASSESSED

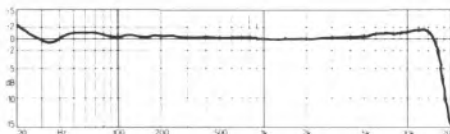
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



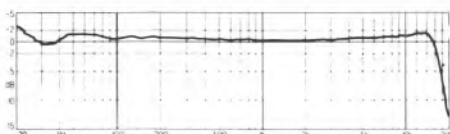
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

AIWA WX200

AIWA (UK) LTD, UNIT 2, DUKES ESTATE, WESTERN AVENUE, LONDON W3 0SX.

TEL: 01-993 1672



Aiwa's high standards of styling have been maintained on this dual auto-reverse, dubbing deck. It looks extremely complex, yet is simple to operate. Legends and symbols clarify rather than confuse, which is refreshing. The characteristic Aiwa ledge has been extended to accommodate a plethora of extra controls, so the fascia doesn't have that common job lot look. Further improving clarity, the status displays have their own section on the right of the deck.

Tape selection is automatic for both decks, but neither has a status display, whereas both Dolby B and C noise reduction have clear green and red indicators. The transport is smooth if noisy, and accepts most commands easily, save punch-in record. Record mode is one-touch, and a review/cue capability is also included. Record mode allows simultaneous recording, recording on Tape 2 only, or continuous recording. Dubbing starts automatically, and extra facilities include a Memory Random Program Music Sensor, a Music Sensor, and blank-skip.

The peak LED level meter has a broad range (-15 to +10) but poor resolution. Record levels are set by stable sliders.

LAB REPORT

The twin auto-reverse decks displayed no sign

of reverse azimuth errors, but did show rising treble output in their replay frequency response. Quite why the Japanese feel a need to boost treble so much on dubbing decks compared to their conventional models remains mysterious. Perhaps it is to counteract the effects of wear in the rotating head block, which raises doubts about the useful life of these decks.

The extra treble boost in the replay amplifier needed to achieve this result has raised hiss by 7dB, bringing it close to the inherent hiss of chrome tape. Consequently ultra low noise tapes, like new TDK SA for example, offer no advantage in this respect.

Speed stability was very good on both decks and in both directions of play: so was speed accuracy. The spectrum analysis shows a very sharp peak, indicative of low basic drift and hence wow. There's flutter too, but at an acceptable level.

The record head overloaded severely when trying to cope with the very high signal/bias level required for metal tape, recording to 0VU generating 7% overall distortion. Recordings on ferric, chrome and metal tape exhibited around +2dB treble lift, which was emphasised by the dubbing process to result in +5dB treble lift. The AX200 will produce very bright-sounding copies.

SOUND QUALITY

The lab tests were confirmed in listening. Musicassettes had fearsome treble with almost no bass, this lack of balance giving a nasty and unpleasant overall sound.

Maxell MX (metal) also suffered from harsh treble, tending to get messy and muddled at high levels. Treble lift was accentuated using TDK MAX, distorting badly at high levels. Piano pitch was stable enough on chrome (BASF CR-ElI), if a touch watery in quality. Motor noise was clearly discernible on TDK SA. Treble was on the soft side, but dynamic range was good, if a bit 'flattened out'. TDK AD (ferric) suffered 'biting' treble, with an unpleasant degree of sibilance made worse by messiness and blurring at high levels. Transient attack was 'softened' to the point of being overwhelmed.

Dubbing quality followed this trend. At both normal and high speeds the result was compressed dynamic range, 'biting' treble, and an overall sound that was thin and 'watery', lacking any sense of 'punch'.

SUMMARY

The WX200 looks a lot better than it performs. Easy to use, and with a complex but attractive appearance, it nevertheless suffered from severely boosted treble on both recordings and with pre-recorded tapes. There was distortion at high levels too, notably with metal tapes. In particular the dubbing results were poor, accentuating the response problems suffered on all tape types.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response	40Hz-7.0kHz	poor
Speed accuracy	+0.8%	good
Noise	-53dB	very poor

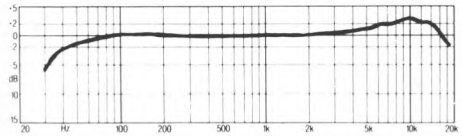
Record/replay using blank tape

Frequency response, ferric	20Hz-15.0kHz	very good
Frequency response, chrome	20Hz-14.0kHz	good
Frequency response, metal	20Hz-15.0kHz	very good
Stereo separation	-48dB	average
Distortion	7.0%	very poor
Noise	-52dB	average
Speed variation	0.05%	very good
Modulation noise	-37dB	poor
Flutter energy (band level)	-29dB	good
MOL, ferric, 315Hz/10kHz	+2.0dB/-9.0dB	average
MOL, chrome, 315Hz/10kHz	+0.5dB/-11.0dB	poor
MOL, metal, 315Hz/10kHz	-9.0dB/-7.0dB	very poor

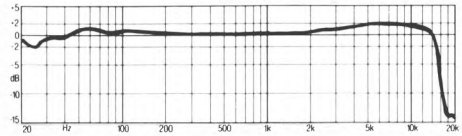
Input/output performance

Line in (sensitivity/overload)	65mV/>3V
Mic input (sensitivity/overload)	None
Output	500mV
Typical price inc VAT	£299

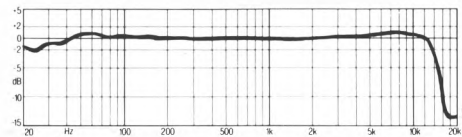
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



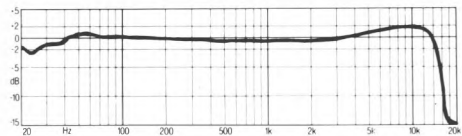
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

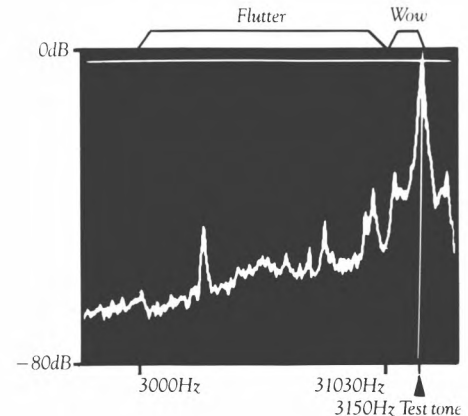


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



AIWA AD-F770

AIWA (UK) LTD, UNIT 2, DUKES ESTATE, WESTERN AVENUE, LONDON W3 0SY.
TEL: 01-993 1672



Although moderately expensive, the *F770* is packed with features, most of which are really useful. There is the inevitable sprinkling of extras like music search and intro-play, but these don't push aside the more worthy assets of a dual capstan transport with full logic control, automatic tape tuning ('DATA' system in Aiwa's terminology), independent record and replay heads (siamesed) for off-tape monitoring whilst recording, and Dolby HX Pro. This is quite a line up: the dual capstan transport reduces flutter to give improved clarity; logic control makes for easier operation and permits automatics; the 'DATA' system ensures perfect compatibility with all blank tapes; off-tape monitoring allows recording quality to be checked whilst the recording is actually being made; and Dolby HX Pro gives cleaner, less confused treble.

Though the front panel looks 'busy', it is less so than the *AD-F990*, and much of the effect is due to numerous indicators. Automatic tape type selection rendered the *F770* relatively easy and foolproof to use. DATA information is retained in memories (one for each tape type), and for roughly 24 hours after power is switched off. A large, four-digit tape counter with zero-stop and time indication is fitted, plus very long record indicators with good range and resolu-

tion. This machine is well built and proved easy to use, the only point worth mentioning is that the horizontal front control ledge is not practical on high shelves and collects dust.

LAB REPORT

The electronic circuits of this machine curiously have +1dB plateau low frequency boost. The DATA system consistently gives +1dB treble lift with all tapes, resulting in the curious 1kHz dip just visible in the record frequency response graphs. Dolby C emphasised the effect below about -10dB, especially around 300Hz where a just-audible up to +2dB lift appeared. Otherwise the DATA system (which laudably adjusts bias, record gain and then record gain and then equalisation, using a comprehensive set of test tones) produced very consistent results. It has enough adjustment range to compensate for all tapes including awkward ones like BASF CR-III and Maxell XL-IS. Exceptional resolution got record gain right every time, within a fraction of a dB.

Bias was set a bit high in my opinion, favouring low midband/bass distortion (0.4% and 0.2%!) at the expense of treble overload which, in spite of HX Pro, was on the low side — especially for metal tape (-2dB). I suggest the use of high-saturation metals (see tape tests) like TDK MA and Sony ES, since the 770 will tune

them in accurately.

The transport had little flutter and not a lot of wow either. Test tones sounded quite stable though spectral analysis showed that some audible 'pitch indecision' was due to numerous low-level wow components clustered around 5Hz. I was disappointed that the replay frequency response was not flat; falling treble (-2dB at 12kHz) will make musicassettes sound dulled. Dolby B magnifying the problem. Replay hiss was very low, and replay speed spot-on. At -59dB, hum should have been lower.

SOUND QUALITY

Recordings with Sony ES metal (DATA tuned) had an 'itchy' high treble sounding over-busy. Otherwise, an even tonal balance and an excellent sense of clarity make recordings much like the original. Speed stability was excellent, notes having fine steadiness and treble being free of the 'coarseness' which results from flutter. BASF CR-III had an over-large bass sound due to a small tune error with this tape. Transient edges were slightly 'softened' too. Otherwise, it was metal-like and considered excellent. In comparison TDK SA was smooth, but in a 'creamy' and 'opaque' sense. It was pleasant, but less revealing than CR-III; bass was lighter though. Ferric (TDK AD) was grainy at high frequencies, and a bit smeared and coarse. There was plenty of treble level though, and we felt that AD performed well on this deck.

Musicassettes had 'boomy' bass, but plenty of bass impact. Treble was 'smeared' and 'grey'. The 770 was neither sweet nor explicit in this area. Low level detail was largely lost and treble 'leadens'. Imaging was vague by the best standards, but pitch stability on sustained notes was obviously excellent.

SUMMARY

The AD-F770 is a high performance machine, well built and finished. Although daunting because of its apparently complex front panel, in practice it is easy to use. Main features of interest are a dual capstan logic controlled transport, automatic tape type sensing, independent record and replay heads for immediate off-tape monitoring, Dolby B, C and HX Pro.

Recording quality reached a very high standard with all tape types. Replay quality with

musicassettes was marred by poor adjustment, resulting in a somewhat bland sound with leaden treble. It is a pity that such a fine deck should be compromised by this important detail.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response	251Hz-12.0k1Hz	good
Speed accuracy	+0.0%	excellent
Noise	-61dB	good

Record/replay using blank tape

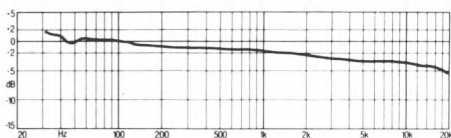
Frequency response, ferric	201Hz-17.0k1Hz	very good
Frequency response, chrome	201Hz-18.0k1Hz	very good
Frequency response, metal	201Hz-18.0k1Hz	very good
Stereo separation	-46dB	average
Distortion	-0.3%	very good
Noise	-55dB	very good
Speed variation	0.06%	good
Modulation noise	-40dB	good
Flutter energy (band level)	-33dB	very good
MOL, ferric, 3151Hz/10k1Hz	+4.0dB/-7.5dB	good
MOL, chrome, 3151Hz/10k1Hz	+0.0dB/-8.0dB	average
MOL, metal, 3151Hz/10k1Hz	+5.0dB/-2.0dB	very poor

Input/output performance

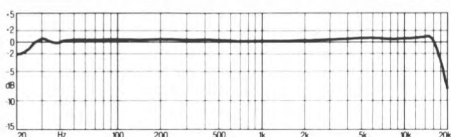
Line in (sensitivity/overload)	60mV/>3V
Mic input (sensitivity/overload)	0.3mV/30mV
Output	360mV
Typical price inc VAT	£299

REASSESSED

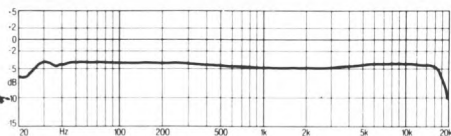
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



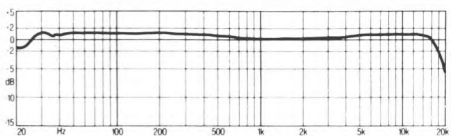
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



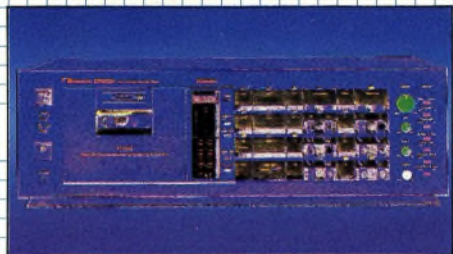
Type II (chrome or pseudochrome)



Type IV (metal)

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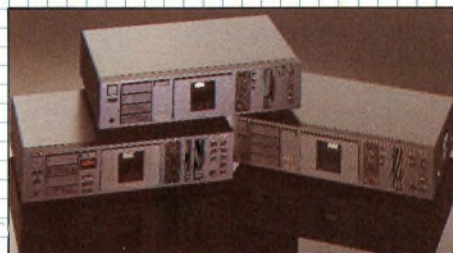
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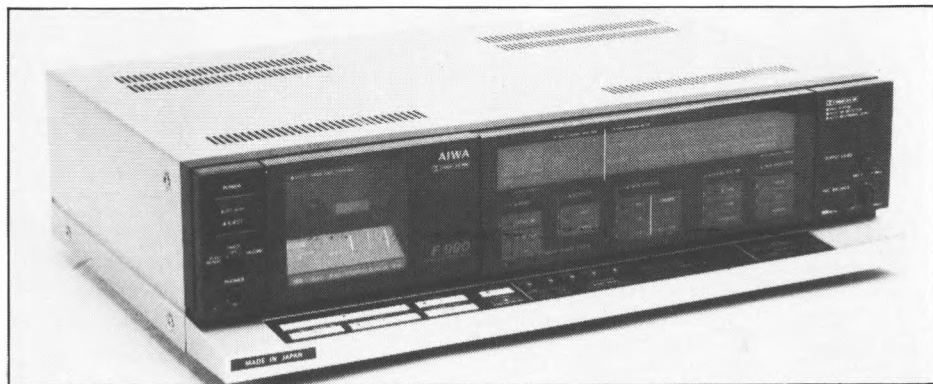


RECOMMENDED

AIWA ADF990

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TEL: 01-993 1672



Currently Aiwa's top-of-the-range model, the ADF900 incorporates Dolby HX-Pro 'headroom expansion' as well as the usual B and C noise reduction systems. HX-Pro allows higher treble recording levels by dynamic variation of bias. In addition to this, the 990 has an automatic tape calibration system that records a short sequence of tones on to tape; the machine monitors these and makes a series of internal adjustments which allow it to give its best results with a wide variety of tape formulations.

Tape selection is automatic, catering for ferric, chrome and metal tape types. The auto tape matching system successfully accepted old metal tapes (without sensing slots) in the chrome position, giving perfect results. The adjustment range of this system is obviously very wide. Dolby selection is also automatic but this can be manually over-ridden.

Tape transport controls are positioned on a dust-collecting platform which protrudes from the bottom edge of the fascia panel. Associated logic allowed 'punch-in' recording from play mode and immediate fast reverse from record mode. Cue/review was also incorporated.

Record level is adjusted automatically but it is also possible to adjust the level manually using an electronically stepped attenuator which

clicks (literally!) up, or down, in 2dB steps.

This is a stylish, well-built machine. It has an excellent tape counter which also displays time remaining on tape. Bright blue fluorescent record level meters have good resolution and tests showed that they accurately indicate transients and low and high frequency signals. The multiplicity of buttons and lights were a bit confusing at times, but Aiwa seem to have forgotten nothing on this flagship product.

LAB REPORT

Replay frequency response, Dolby B tracking head height and speed were all accurately set, guaranteeing good fidelity with pre-recorded cassettes.

Speed stability was excellent in all areas, except for the presence of 5Hz wow sidebands at -19dB. The ear/brain is very sensitive to wow at this frequency and it is the sort of thing that is audible on organ and piano in particular. Otherwise, little energy was lost into flutter, equivalent level measuring -31dB, or 3% distortion. This is far lower than most decks and results in improved clarity by reducing mush. Conventional distortion was otherwise extremely low at all frequencies, with an average value of just 0.6%.

Peak record level (0VU) has been set -3dB below Dolby flux, even though the meters

accurately peak read. Our noise figures, being relative to 0VU, are therefore poor. Aiwa put advisory peak level legends on the record display though and if these are followed, noise levels will be no different from those of other good decks.

Due to DATA tape tuning and Dolby HX-Pro, maximum output level values in the mid-band and at high frequencies were very high. For example, the IEC I (ferric) Primary Reference Tape had +4dB extra treble headroom than is usual, with no loss in mid-band headroom. Record/replay frequency responses were extremely flat with all tape types, as the graphs show. Identical results were obtained with either Dolby B or C switched in, which is a very impressive result.

The ADF990 had an exemplary measured performance, except for 5Hz wow with a sideband level of -19dB. This was one niggling blemish.

SOUND QUALITY

On high level programme without sustained piano notes, it was difficult to tell the difference between the ADF990 and Compact Disc, when using metal tape (TDK MA). The sound was generally clean and open, with excellent tonal balance. Some harshness, due to flutter sidebands, was occasionally detected. Sustained piano notes were heard to wobble too, due to 5Hz wow. In spite of these effects though, we had to be impressed by reproduction from this machine.

Type II 'chrome' tapes also gave good results, but sounded 'softer' than metal and treble compression was occasionally detected as softening 'top'. The sound was a bit less hard than that of metal and was liked.

Ferric tape sounded a bit brittle, like metal, and noise was higher, but performance was still excellent.

Replay quality with pre-recorded cassettes was excellent, but again we noticed the 'jelly-like' quality to pitch that slow-rate wow produces. Otherwise, there was good imagery, plenty of attack on transients and even tonal balance. No degradation occurred at low levels with Dolby B engaged.

Finally, a faint rumble was heard, which analysis defined as 1f energy around 20Hz. This should rarely be annoying, but is strange.

SUMMARY

The ADF990 gave impressive sound quality for the cassette medium, with all tape types and with pre-recorded musicassettes. It is an impressive deck. But though the '990 benefits from its dual capstan drive, Aiwa could further hone the speed stability performance to keep this deck up with the leaders.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 201 Hz-20.0kHz very good
Speed accuracy _____ 0.15% very good

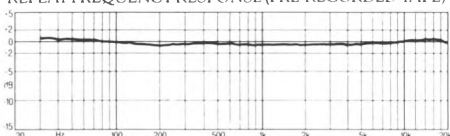
Record/replay using blank tape

Frequency response, ferric _____ 221 Hz-18.0kHz very good
Frequency response, chrome _____ 211 Hz-18.0kHz very good
Frequency response, metal _____ 251 Hz-16.0kHz very good
Stereo separation _____ -52dB good
Distortion _____ 0.6% good
Tape hiss, ferric _____ -65dB poor
Tape hiss, chrome _____ -69dB poor
Tape hiss, metal _____ -66dB average
Speed variations _____ 0.1% good
Modulation noise _____ -41dB good
Flutter energy (band level) _____ -34dB very good
MOL, ferric, 315 Hz/10kHz _____ +4.0dB/-6.0dB very good
MOL, chrome, 315 Hz/10kHz _____ +1.0dB/-6.0dB good
MOL, metal, 315 Hz/10kHz _____ +4.4dB/-1.0dB good

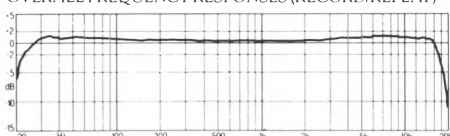
Input/output performance

Line in sensitivity/overload _____ 52mV/-V
Mic input sensitivity/overload _____ 1mV/65mV
Output level _____ 330mV
Typical price inc VAT _____ £350

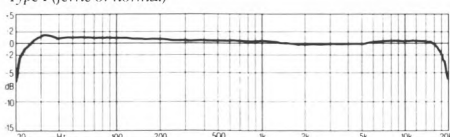
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



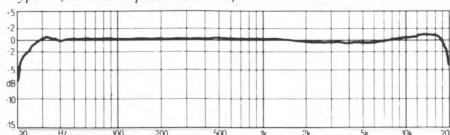
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)

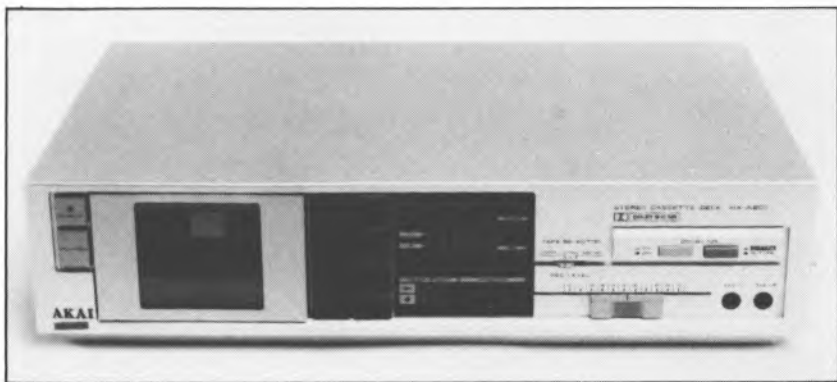


Type IV (metal)

RECOMMENDED

AKAI HX-A201

AKAI (UK) LTD, UNIT 12, HASLEMERE HEATHROW ESTATE, SILVER JUBILEE WAY, HOUNSLOW, MIDDLESEX. TEL: 01-897 6388



This budget Akai deck has Dolby C noise reduction, but not the logic-controlled transport of the 'A3, nor its attractive blue fluorescent displays. Instead, the transport buttons are mechanically interlinked, enabling fast reverse to be selected from fast forward, for example. However, more awkward changes, like fast reverse from recording mode are not possible, and the buttons were a bit stiff and clanky. They were poorly identified too, having symbols impressed directly into the grey plastic surface without any distinguishing colour.

Simple record level meters have three green and two red LEDs on each channel to cover a recording range of -15dB to $+3\text{dB}$. Because of adjustment, the maximum $+3\text{dB}$ LED was in fact about equivalent to $+6\text{dB}$ on most machines, which is needed to show the upper recording limit for metal tapes.

Tape type selection is manual, while the counter is an unlit mechanical type without a zero stop function. Akai fit a headphone socket and twin microphone inputs, while auto-start from an external timer is also possible.

LAB REPORT

Head azimuth of the review sample had been perfectly set, which is rare at these price levels. As a result of this — and absolutely correct

replay equalisation in the machine's electrical circuits — replay frequency response was virtually ruler-flat from 100Hz right up to 18kHz ! Some bass boost occurs below 100Hz .

The replay amplifiers were very quiet and relatively hum-free. Head height had been set accurately enough for good track alignment, resulting in low crosstalk. Speed accuracy was adequate and replay speed stability respectable at the price. Regular but slight speed warble was obvious and spectral analysis showed this was due to capstan eccentricity (7Hz). Flutter was also seen, but both were relatively low.

Record/replay speed stability, where transport defects become additive (record plus replay) amplified the capstan wow phenomena a little and brought up flutter to a level of -28dB , which is still fairly respectable for a budget single-capstan unit.

The head suffered no more distortion than usual (1.2% overall) with the high bias and signal levels required for metal tape, and record bias noise was low. Dolby C didn't quite manage -20dB of noise reduction, so record bias noise was sub-optimal by $+2\text{dB}$ at -71dB , with chrome (BASF CR-EII) tape. This is a small and acceptable degradation though, and basically, the HX-A201 does give low noise with quiet tapes.

Tape overload figures (MOLs/SATs) showed

well-set bias and reasonable head performance again. Chrome sensitivity was set (-2.2dB) for Japanese pseudo-chrome tapes such as Sony UCX, and record equalisation was set for them too. Such tapes should be used for best results with Dolby operative. Frequency response was flat for commonly available ferric and metal tapes, and so was sensitivity. As a result, Dolby tracking proved perfect.

The Akai HX-A201 measured unusually well in all areas — I really could not fault it at the price.

SOUND QUALITY

Strong, deep bass gave musicassette reproduction an uncommon feeling of dimension or weight. There was obvious treble extension and a fine sense of detailing with good recordings. Loss of precision and depth was noted — but only against a Nakamichi *Dragon!* Low level musical passages were not dulled appreciably. Slight hum was noticed.

With Sony ES the HX-A201 gave first class recordings, reasonably free of 'wiriness' and other vices. Slight pitch corruption was detected with violin and piano on occasion, introducing a 'broken' sound, as is to be expected with budget machines. There was the usual small loss of clarity too. Otherwise, the sound was beyond serious criticism. Hum was again evident.

Chrome tape (Sony UCX) gave a softer, more rounded presentation than metal, with suppressed treble and some obvious coarseness of pitch. It had a slightly 'wiry' quality. As usual, ferric tape (TDK AD) sounded similarly muted and vague in its upper registers, but on balance it gave very respectable results in this Akai.

SUMMARY

The HX-A201 is a budget deck with an absolute minimum of frills, albeit retaining Dolby C noise reduction. It has a fairly attractive appearance, free from the gaudy 'lights and legends' look so common on budget products.

Measured performance was exemplary in all areas, well beyond what is normally expected at the price. It was capable of getting the best out of pre-recorded musicassettes, lacking the usual dull, muddled and imprecise sound common to budget decks.

Similarly, recordings reached a very good

standard with ferric, chrome and metal tapes. If Akai can maintain this performance in production, the HX-A201 will be an almost unbeatable bargain for those with a strictly limited budget.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 32Hz-20.0kHz very good
 Speed accuracy _____ +0.7% good
 Noise _____ -59dB average

Record/replay using blank tape

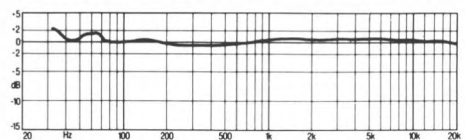
Frequency response, ferric _____ 20Hz-16.0kHz very good
 Frequency response, chrome _____ 20Hz-15.0kHz very good
 Frequency response, metal _____ 20Hz-15.0kHz very good
 Stereo separation _____ -51dB good
 Distortion _____ -1.2% average
 Noise _____ -53dB good
 Speed variations _____ 0.10% good
 Modulation noise _____ -38dB average
 Flutter energy (band level) _____ -28dB good
 MOL, ferric, 315Hz/10kHz _____ +3.0dB/-7.0dB good
 MOL, chrome, 315Hz/10kHz _____ -1.5dB/-7.0dB very poor
 MOL, metal, 315Hz/10kHz _____ +2.0dB/+0.0dB poor

Input/output performance

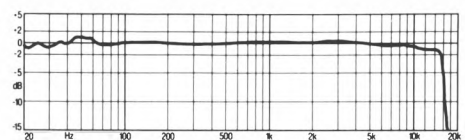
Line in sensitivity/overload _____ 80mV/>3V
 Mic input sensitivity/overload _____ 0.3mV/30mV
 Output level _____ 420mV
 Typical price inc VAT _____ £99

REASSESSED

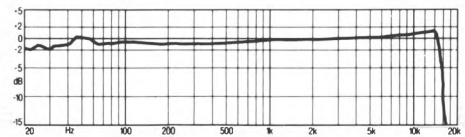
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



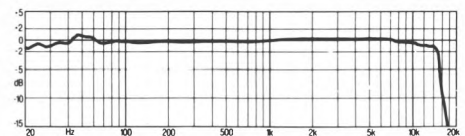
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



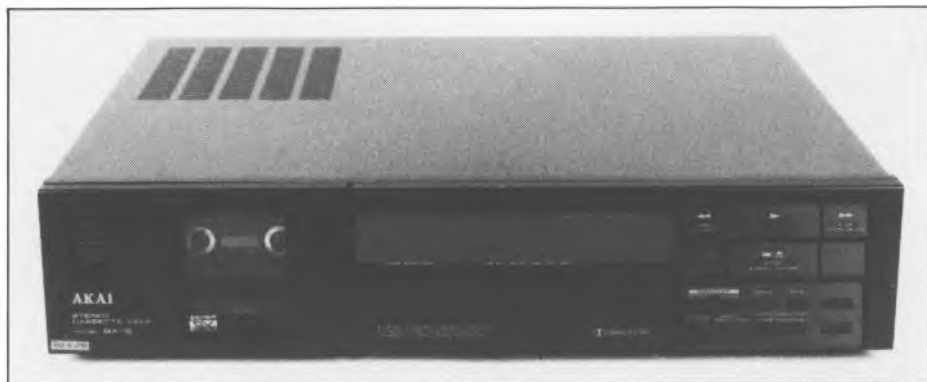
Type II (chrome or pseudochrome)



Type IV (metal)

AKAIGX9

AKAI (UK) LTD, UNIT 12, HASLEMERE HEATHROW ESTATE, SILVER JUBILEE WAY, HOUNSLOW,
MIDDLESEX. TEL: 01-897 6388



This three head, dual-capstan drive machine from Akai combines sophisticated facilities, clean styling and simple operation in one slimline if substantial package. The logic transport is smooth and very quiet, accepting all commands save 'punch-in' record without a hitch. A Quick Memory Search System and Instant Programme Locating System are situated beneath the transport, along with auto fade and auto monitor from tape or source; QMSS will return tape to zero preset on the counter, while IPLS plays the next or the last track on a cassette.

Other facilities include Dolby B and C (selected by mutually dependant buttons), multiplex filter, record balance and level, manually adjusted bias, and a headphone socket; these are tucked away behind a hinged panel beneath the display console. This does away with the cluttered appearance typical of many machines in this price bracket. Tape selection is automatic, with a fluorescent status display.

An unusual feature is rapid automatic tape tuning, carried out every time record-pause is selected. Manual bias can be adjusted afterwards to adjust the tonal balance of a recording, if desired. Akai's peak level meter uses a fluorescent white display, with broad range and good resolution. The cassette door closes

automatically when any function button is pressed.

LAB REPORT

The GX-9 proved to have a very flat replay response with musicassettes. Output was maintained right up to 18kHz without loss. Pre-recorded tapes should consequently sound bright, clear and well defined.

Little hum or noise was measured in the replay amplifiers, while replay speed accuracy proved acceptable, but with an unusual -0.7% error. (Most Japanese decks run a bit fast relative to the IEC test tape I use.) The dual-capstan transport exhibited very little drift, wow or flutter, as the spectrum analysis shows by its narrow peak at right, low 'shoulders' surrounding the peak, and few humps or spikes at left. This degree of speed stability results in a tight, well controlled pitch-stable sound, ideal for critical music such as piano, for example.

Frequency response of recordings, after tuning, was reasonably flat, as the graphs show. There's some treble lift obvious with metal tape, but it was neutralised by increasing bias. Tape compatibility was beyond reproach.

SOUND QUALITY

Listening tests generally confirmed the lab report. There was slight increase in brightness

with TDK MA-X, but not unpleasant. Increasing bias improved balance, resulting in a recording that sounded clear, open and stable. Tonal balance was excellent with BASF CRE11. A critical piano recording confirmed extremely stable pitch, with solid-sounding — notes. Ferric (TDK AD) sounded a little 'wirey', lacking the smooth richness of the original, but the slight harshness was dampened by adjusting the bias.

Musicassette also sounded bright and open — an unusually good result. However, there was a notable lack of bass 'punch', and flattened perspectives were obvious compared with a reference deck. Some muddle or congestion was heard too. The GX-9 was very good, but not exceptional in this area.

SUMMARY

The GX-9 is a design dedicated to achieving high sound quality, incorporating a dual-capstan transport and automatic tape tuning, plus many useful facilities. A hinged front panel hides most minor controls.

Recording quality reached a high standard with ferric, chrome and metal tapes, the tape tuning system doing a good job in conjunction with the flexibility of user-adjustable bias. Above all, pre-recorded tapes sounded refreshingly clean and entertaining — a strong point in the GX-9's favour.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-18kHz very good
 Speed accuracy _____ +0.7% good
 Noise _____ -60dB good

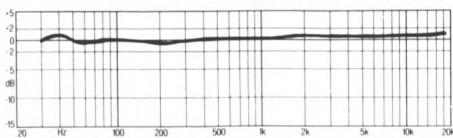
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-20kHz very good
 Frequency response, chrome _____ 27Hz-20kHz very good
 Frequency response, metal _____ 27Hz-20kHz very good
 Stereo separation _____ -52dB good
 Distortion _____ 1.4% average
 Noise _____ -52dB average
 Speed variation _____ 0.04% very good
 Modulation noise _____ -44dB very good
 Flutter energy (band level) _____ -36dB very good
 MOL, ferric, 315Hz/10kHz _____ +3.5dB/-7.0dB good
 MOL, chrome, 315Hz/10kHz _____ +1.3dB/-8.0dB good
 MOL, metal, 315Hz/10kHz _____ +4.0dB/-2.0dB very poor

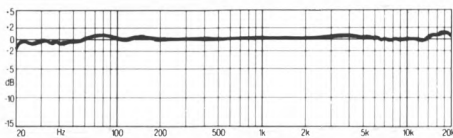
Input/output performance

Line in (sensitivity/overload) _____ 100mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 600mV
 Typical price inc VAT _____ £349

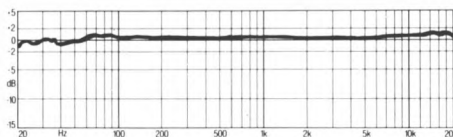
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



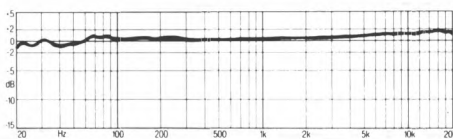
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

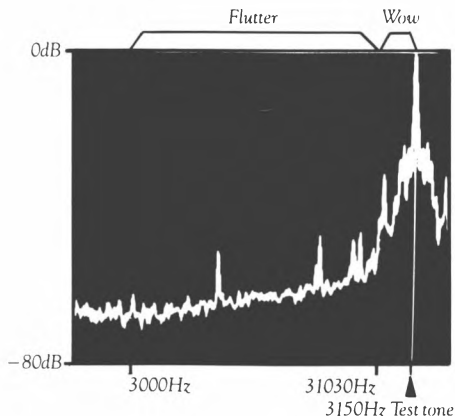


Type II (chrome or pseudochrome)



Type IV (metal)

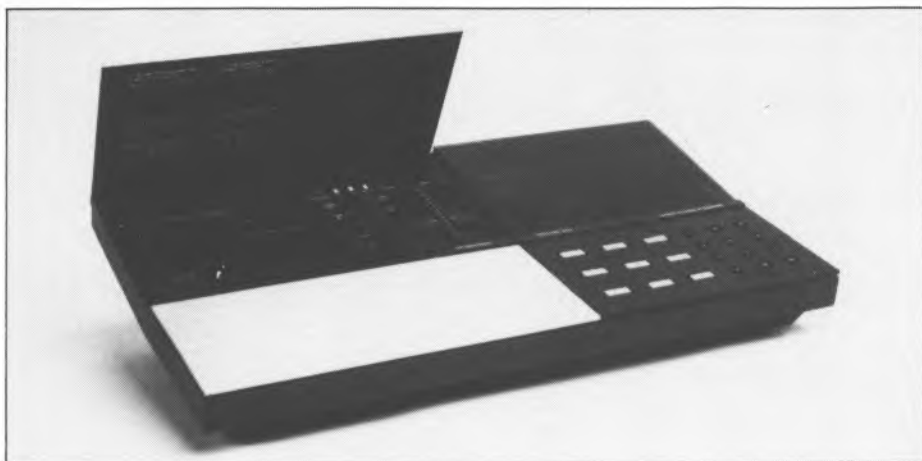
WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



B&O 9000

BANG & OLUFSEN (UK) LTD, EASTBROOK ROAD, GLOUCESTER GL4 7DE.

— TEL: (0452) 21591 —



Like other B&O products the Beocord 9000 has received a good deal of attention in view of its styling and unusual features. Press a bar marked 'eject', sited between two blank aluminium panels, and the rear one magically swings upwards to reveal the cassette compartment, plus an array of minor facilities like Dolby, tape and timer functions.

Transport control buttons are on the right-hand side of the deck, next to a calculator type keypad. The 9000's tape counter reads time after a frustratingly long calibration period of 1.5 minutes. The keypad allows a wanted programme position to be entered in terms of time, whereupon the deck will fast wind to that point. Various other search features are available too. Logic rejects punch-in recording, but allows rewind direct from record mode. Dolby HX-Pro allows higher treble levels to be recorded onto tape, and Dolby B and C noise reduction are also included.

Tape selection is automatic, but can be overridden to accept ferrichromes and metal tape without sensing slots. Automatic tape tuning is also fitted. Record level meters read the input signal after record equalisation (the signal that is actually going onto tape). This gives accu-

rate indication of treble levels.

LAB REPORT

Sadly the IEC replay response was not good on this machine. It is flat within 1dB only as far as 2kHz, after which there is shelf loss of treble. This effect will be exaggerated by Dolby action, and a dull sound is all that can be expected from musicassettes. Replay speed was accurate.

Broadband noise was used to measure record replay frequency responses, in addition to the swept tone responses, to ensure accurate results with HX Pro system. Generally, the tuning system ensured a flat response to 20kHz. Sometimes tuning error occurred, resulting in excessive treble lift or fall. Retuning was then necessary.

A small amount of extreme treble lift was investigated with wideband red noise (flat to 40kHz). The peak reached around +3dB at 25kHz with all tape types and probably contributed to coarseness heard in listening tests. These peaks were exaggerated by Dolby action.

Factory bias and sensitivity were well set for ferric and chrome tapes. Metal tape was under-biased and there was a sensitivity error of 3dB. The tape tuning system worked well in correcting this and, after calibration, 315Hz maximum

output levels and 10kHz saturations were well set.

Speed stability measured quite well and band level flutter energy was low. However spectral analysis revealed wow components at 1.1Hz, 2.2Hz, 3.3Hz, and capstan wow at 6Hz. Measured flutter deviation was not low for an expensive deck, measuring 0.2%.

B&O have set 0VU at Dolby flux level and this, plus falling treble in the replay response, helped toward a very low noise level of -74dB with TDK SA tape. On the other hand the overall average distortion figure was high at 2.3%, and this could account for a 'gritty', harsh tonal character that was noticed during listening tests.

SOUND QUALITY

Initially we found the B&O 9000 gave disappointing results with all tape types. The music was consistently accompanied by low-level distortion with a 'gritty', 'blasting' character that was unpleasant and wearing. This effect was probably due to a combination of speed instability, distortion and the presence of a degree of extreme-treble lift. We found the use of BASF tapes with special mechanics helped slightly.

Using metal tape, tonal balance was neutral in the midrange, but some coarseness in the sound was noticed. Wow was heard as a slight warble but this was not serious. TDK SA gave a neutral tonal balance, but again there was a 'papery,' lifeless sound. BASF *Chromdioxid II* gave a better result all round. The sound was cleaner and reached a high standard. Distortion was heard with ferric tape, but tonal balance was subjectively even.

Musicassette reproduction suffered from the falling replay response; it sounded dull and had muted detail. Stereo imaging was stable and well defined.

SUMMARY

We were somewhat disappointed by the performance of the *Beocord 9000*. Sound quality using BASF *Chromdioxid II* was good, but in general results were thought mediocre. Considering the high price, value for money is poor.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 20Hz-7kHz average
Speed accuracy _____ 0% excellent

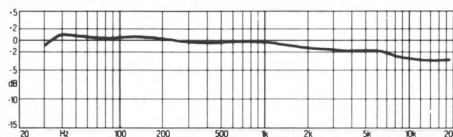
Record/replay using blank tape

Frequency response, ferric _____ 30Hz-3kHz see text
Frequency response, chrome _____ 30Hz-3kHz see text
Frequency response, metal _____ 30Hz-3kHz see text
Stereo separation _____ -52dB good
Distortion _____ 2.3% average
Tape hiss, ferric _____ -66dB good
Tape hiss, chrome _____ -74dB very good
Tape hiss, metal _____ -72dB very good
Speed variations (wow and flutter) _____ 0.05% very good
Modulation noise _____ -38dB good
Flutter energy (band level) _____ -27dB good
MOL, ferric, 315Hz/10kHz _____ +4dB/-5.5dB very good
MOL, chrome, 315Hz/10kHz _____ +1.2dB/-7.0dB good
MOL, metal, 315Hz/10kHz _____ +3.4/+0.5dB average

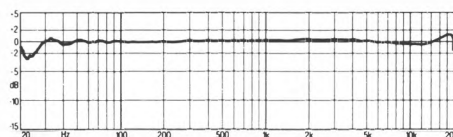
Input/output performance

Line in (sensitivity/overload) _____ 44mV/-V
Mic input (sensitivity/overload) _____ 0.2mV/100mV
Output _____ 800mV
Typical price inc VAT _____ £735
REASSESSED

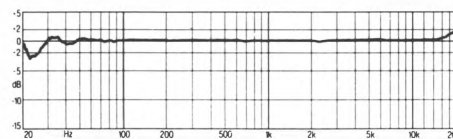
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



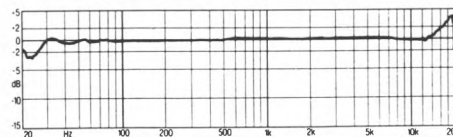
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

DENON DR-M10

HAYDEN LABORATORIES, HAYDEN HOUSE, CHILTERN HILL, CHALFONT ST PETER, BUCKS SL9 9UG.

· ——— TEL: (0753) 888447 ——— ·



The DR-M10 doesn't have the dual capstan transport of the popular DR-M22 (now M20), but it does have automatic tape type selection, thus avoiding the all too common possibility of user error. Variable bias with ferric and chrome tapes offers accurate tape matching. A 'track search' facility can be particularly useful with pre-recorded tapes, but this is all there is in the way of gadgets. The worthwhile Dolby system indicators are situated above the tape selection display.

The logic-controlled transport works very smoothly and quietly. Operating buttons have a firm action and come to hand easily, being large and clearly laid out. The only feature likely to confuse the uninitiated is that the transport buttons are marked with symbols alone. However, they are designed to reflect their function and can be understood without too much difficulty. Recording is interlocked with play so that the record and play buttons must be pressed simultaneously; pressing record alone usefully puts the deck into record-pause, so record levels can be set. Denon fit the usual type of LED record-level display, with green and red go and no-go areas.

There are no microphone inputs, but a

headphone socket is provided with independent output level control.

LAB REPORT

Peak record level, or OVU, has been set at Dolby flux, which is around 3dB higher than most of the budget decks. The justification can be seen in the MOL figures, which were all on the high side, with metal tape almost on par with ferric tapes — a very good result. The head is therefore capable of accepting strong signals before saturation, only low frequencies being an exception. Bass distortion was on the high side, partly as a result of the high peak record levels used.

Bias can be varied with ferrics and chromes, but not metals. Ironically, a flat frequency response has been achieved with ferric and chrome tapes (at centre bias) but not with metal, as the graph shows, so variable metal bias would have been more useful than the others.

SOUND QUALITY

In practice we found that TDK MA and Sony ES tapes sounded only slightly bright, with an occasional sharp, piercing sibilance, or 'spitty' quality. Maxell MX gave the best results, due to its inherently falling treble and very smooth

running, the *DR-M10* producing some impressive recordings here. Good recordings also came with ferric and chrome tapes, although some dirtiness in the sound was detected, due to excessive flutter. A critical piano recording revealed slight pitch vagueness — a 'watery' quality, but the *DR-M10* still managed relatively well here. Quite loud motor roar, sounding a bit like hum, was detected on low level piano.

Like other Denons, the *DR-M10* gave a very dull sound with pre-recorded tapes, being nearly -4dB down at 10kHz. This was the machine's main weakness and rather spoilt what would otherwise have been a rosy picture.

SUMMARY

The *DR-M10* was especially pleasant to operate, with its light action touch buttons and smooth transport action. Automatic tape sensing eliminates the tedium of button pushing when changing between tapes, and variable bias matches the deck accurately, though not to metals. The deck proved capable of producing high quality recordings, though it does not rise significantly above the current norm for a competent deck in this area. Replay quality of pre-recorded tapes bordered on the unacceptable. They sounded dull and turgid, severely compromising our overall opinion.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-8.0kHz average
 Speed accuracy _____ +0.2% very good
 Noise _____ -57dB poor

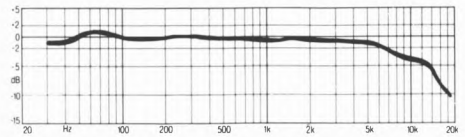
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-15.5kHz very good
 Frequency response, chrome _____ 27Hz-16.5kHz very good
 Frequency response, metal _____ 27Hz-14.0kHz good
 Stereo separation _____ -42dB poor
 Distortion _____ 2.2% very poor
 Noise _____ -53dB good
 Speed variation _____ 0.06% very good
 Modulation noise _____ -41dB good
 Flutter energy (band level) _____ -19dB poor
 MOL, ferric, 315Hz/10kHz _____ +4.0dB/-9.0dB average
 MOL, chrome, 315Hz/10kHz _____ +1.5dB/-9.0dB average
 MOL, metal, 315Hz/10kHz _____ +3.2dB/+0.0dB average

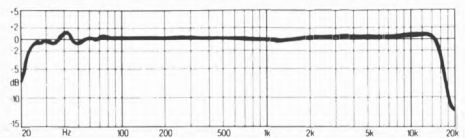
Input/output performance

Line in (sensitivity/overload) _____ 110mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 750mV
 Typical price inc VAT _____ £180

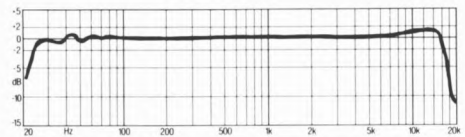
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



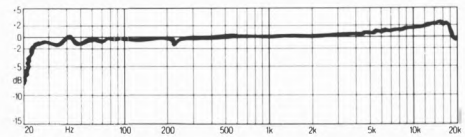
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

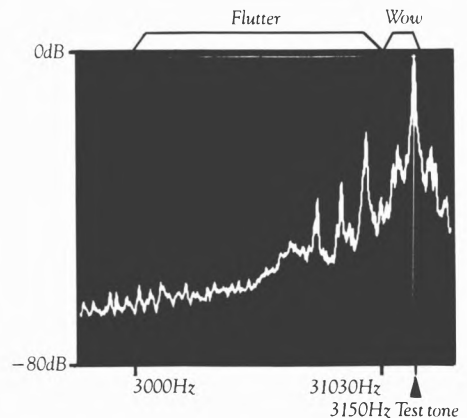


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



BEST BUY

DENON DR-M20

HAYDEN LABORATORIES LTD, HAYDEN HOUSE, CHILTERN HILL, CHALFONT ST. PETER, BUCKS.

TEL: (0753) 888447



The DR-M20 replaces the DR-M22, which gathered a fine reputation for offering impressive quality at a reasonable price. Like its predecessor, the 'M20 has a dual capstan transport, and independent (siamesed) record and replay heads enable it to monitor a recording as it is made: this makes tape tuning much easier, since one can switch directly between source recorded and recording, directly comparing quality. The inclusion of adjustable bias is therefore all the more worthwhile, but unfortunately, this facility does not operate on metal tape, so non-standard metals (of which there are an increasing number — see tape tests) cannot be tuned in.

It was immediately noticeable that the DR-M20 is much quieter in operation than the 'M22 and its light-touch logic controlled transport accepts all unusual commands, like reverse direct from record and 'punch-in' record.

Making life much easier is an automatic tape type selector system with clear, illuminated legends on the fluorescent display panel. Clear indicators also monitor Dolby operation, record mode, tape/source monitoring, etc.

LAB REPORT

Nearly every aspect of measured performance was impressive, just as with the DR-M22 before. However, one surprising blemish was capstan wow in the transport, hopefully confined to this early sample from Japan. This measured 0.1%, and is clearly visible as side spikes to the main test tone on the right hand side of the flutter analysis. Otherwise, negligible drift, wow and flutter are obvious properties of the twin-capstan transport design, fully validating its use.

Replay frequency response has been slowly improving in the Denon models, and here measured -1.5dB at 10kHz , which is a great improvement on earlier machines. The treble roll-off above 10kHz is, however, likely to be audible as a loss of 'sparkle' when playing pre-recorded tapes.

Hiss in the replay amplifiers was adequately, though not exceptionally low, and hum was not a problem. However the DR-M20 doesn't have sufficiently low noise to exploit TDK's fully new ultra quiet SA-X chrome tape, returning -73.5dB noise with Dolby C, compared to values a few dB better from other machines. Despite not possessing Dolby HX PRO, the DR-

M20's head gave astonishing overload figures, right up in the top class figures, with +6dB onto metal tape, a level virtually unmatched by other machines.

SOUND QUALITY

As expected, recordings made on the 'M20 reached a superbly high standard, with a naturalness and clarity not often encountered. However, there were some blemishes. Metal tape (TDK MA-X) was over-bright, albeit clean and inoffensive. Furthermore, piano notes were quite strongly modulated by capstan wow, giving them too much character and occasional 'shakiness'.

Negligible drift ensured a wonderfully 'tight' sound, quite as obvious with pre-recorded tapes as it was with recordings. A good dual-capstan recorded mechanism like that in the M20, really makes its abilities known. Pre-recorded tapes did have slightly soft upper treble, but elsewhere clarity was fine and definition superb. Ample dynamic 'punch' ensured a lively, entertaining sound.

SUMMARY

The DR-M20 is one of the most obviously attractive tape decks on the market, providing a near perfect balance between price and performance, and offering a level of sound quality matched by few other decks. Capstan wow marred the purity of piano notes on our early review sample, but hopefully this problem will not affect models which reach the marketplace.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-11.0kHz good
 Speed accuracy _____ +0.5% good
 Noise _____ -58dB average

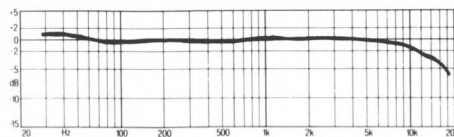
Record/replay using blank tape

Frequency response, ferric _____ 20Hz-18.0kHz very good
 Frequency response, chrome _____ 20Hz-20.0kHz very good
 Frequency response, metal _____ 20Hz-19.0kHz very good
 Stereo separation _____ -51dB good
 Distortion _____ -0.7% good
 Noise _____ -53dB good
 Speed variation _____ -0.10% very good
 Modulation noise _____ -42dB good
 Flutter energy (band level) _____ -34dB very good
 MOL, ferric, 315Hz/10kHz _____ +4.0dB/-8.0dB good
 MOL, chrome, 315Hz/10kHz _____ +2.8dB/-8.5dB average
 MOL, metal, 315Hz/10kHz _____ +6.0dB/+0.5dB average

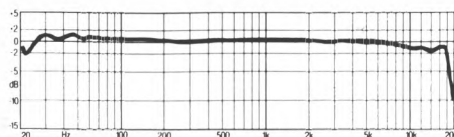
Input/output performance

Line in (sensitivity/overload) _____ 100mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 750mV
 Typical price inc VAT _____ £240

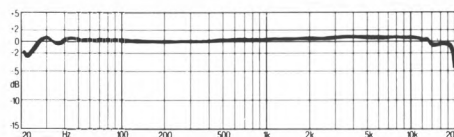
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



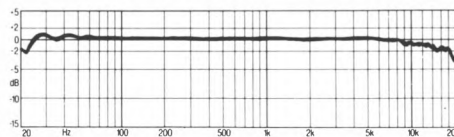
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

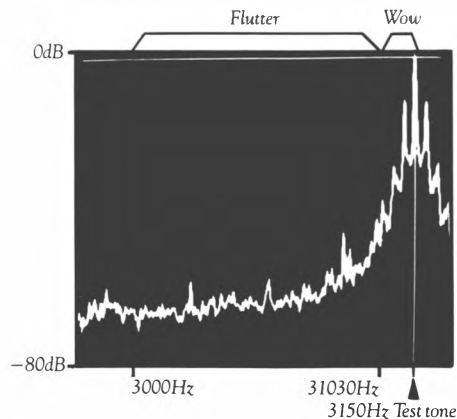


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



RECOMMENDED

DENON DR-M33HX

HAYDEN LABORATORIES LTD, HAYDEN HOUSE, CHILTERN HILL, CHALFONT ST. PETER, BUCKS.

TEL: (0753) 888447



Not surprisingly, the DR-M33HX sits in Denon's range between the DR-M22 and DR-M44HX, borrowing features from each. It uses the dual capstan drive of the '22, without the '44's direct drive motor. The independent but siamesed record and replay heads are employed here to good effect and the '33HX has Dolby HX Pro to enhance recording quality, as well as Dolby B and C noise reduction. The HX Pro circuit modulates bias according to signal conditions, in theory to increase treble overload headroom. However, manufacturers have a lot of leeway to determine what they want from this system, and it appears that Denon have increased standing bias to improve midband headroom too, trading off some potential treble benefits in the process. Bias is also user-adjustable.

The cassette compartment is usefully backlit and tape type selection remains automatic, the latter facility, along with logic control, makes this deck very easy to use. Denon include their familiar bright blue fluorescent display panel, with its warnings and status legends, long record-level indicators and a tape counter, which reads elapsed time and has a zero-stop. Microphone inputs are not fitted.

LAB REPORT

The 1985 Denon had more accurate replay

frequency response, giving better sound quality with musicassettes as a result. The graph for the '33HX shows treble output level up to 10kHz, after which a roll-off occurs. Hiss in the replay amplifiers was adequately low at -58dB , or -68dB with Dolby B, and there was negligible hum. Replay speed was correct and speed stability fine.

A small amount of wow (0.07%) affected recordings, analysis showed equal 4Hz and 6Hz components. A small flutter peak exists at 40Hz too, but there was little energy in it, flutter-band energy measuring a good -29dB . The analysis spectra clearly showed the usual low-flutter benefits of twin capstan drive. At a low -43dB , modulation noise further confirmed the value of dual capstan drive on this series of decks.

Denon have obviously set up the '33HX to meet IEC requirements accurately, including the unconventionally low IEC II chrome tape sensitivity value. As a result, the '33HX has accurate Dolby tracking with BASF CR-EII chrome and low sensitivity (IEC normalised) pseudo-chromes like TDK SA. It is not suited to high sensitivity chromes like TDK HX-S, SA-X, Maxell XL-IIIS and the like. Metal and ferric sensitivities were exactly to IEC II and IEC IV specification.

The graphs clearly show perfectly flat frequency response with IEC-type blank tapes, at centre-bias. Bias adjustment range was just

sufficient to accommodate very awkward tapes like BASF *LH-MI* (ferric) and *CR-MII* (super-chrome), both needing full bias for flat response. Dolby tracking was excellent with all tape types. Midrange overload levels were very high, especially on chrome. For treble, they were good, if not exceptional (see the MOLs in the test results). Coupled with low hiss and hum, these characteristics give the '33HX an excellent dynamic range.

SOUND QUALITY

Musicassette sound quality was extremely good, with a rigid grip kept on tempo. Piano had slight 'wateriness', but this was slight. Rock and classical musicassettes benefitted equally, displaying little of the rhythmic vagueness so common with cassette generally. Upper treble softness was noted and the sense of razor-sharp definition was lost from images and transients.

Maxell MX metal gave very smooth and clear recordings, again with near perfect pitch stability. There was a small loss of inner detail on such instruments as maraccas and the delivery was just a trifle too mellifluous. Sony ES added some bite and verve, but with slight 'jumpiness' to treble, heard on cymbals and the like. Cymbals did, however, ring strongly and clearly, undiluted by flutter.

BASF *CR-MII* super-chrome (bias set near maximum) retained inner and transient detail better than the metals, but had some bass emphasis and lost some of the solidity and sparkle of cymbals. Results were again superb though, and right up to metal standards. All recordings were made with Dolby B.

Hiss became a bit of a nuisance with ferrics (TDK AD and BASF *LH-MI*), so Dolby C was used here. Quality was outstanding for ferric tape, being clearer, easier and more stable to listen to than most decks with metal tape.

SUMMARY

A high performance dual capstan deck, the '33HX has a few extras compared with the DR-M22, most notably Dolby HX Pro, which increases overload margins and dynamic range, putting it on a par with the '44HX in this respect. User adjustable bias gave the deck broad tape matching, and recording performance measured well in all areas. This deck delivered

excellent record/replay sound quality and, equally, it played musicassettes unusually well, providing a pitch-stable, tightly defined sound better than most competitors by a significant margin. Since the '33HX is also a delight to use, it rates very highly indeed.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response	20Hz-11.0kHz	good
Speed accuracy	+0.1%	very good
Noise	-58dB	average

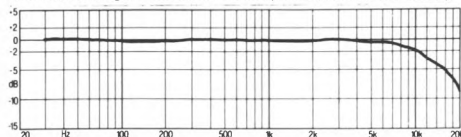
Record/replay using blank tape

Frequency response, ferric	221Hz-18.0kHz	very good
Frequency response, chrome	221Hz-18.0kHz	very good
Frequency response, metal	221Hz-19.0kHz	very good
Stereo separation	-50dB	good
Distortion	0.5%	very good
Noise	-53dB	good
Speed variations	-0.07%	good
Modulation noise	-43dB	very good
Flutter energy (band level)	-29dB	good
MOL, ferric, 315Hz/10kHz	+4.7dB/-3.5dB	very good
MOL, chrome, 315Hz/10kHz	+3.0dB/-6.0dB	very good
MOL, metal, 315Hz/10kHz	+6.0dB/+0.5dB	average

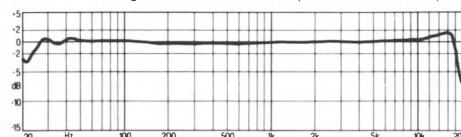
Input/output performance

Line in sensitivity/overload	80mV/>3V
Mic input sensitivity/overload	- mV/- mV
Output level	700mV
Typical price inc VAT	£320

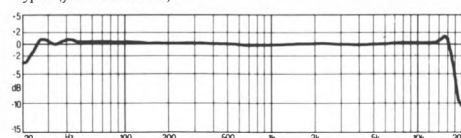
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



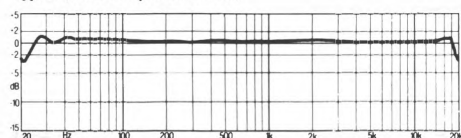
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

RECOMMENDED

DENON DR-M44HX

HAYDEN LABORATORIES LTD, HAYDEN HOUSE, CHILTERN HILL, CHALFONT ST PETER, BUCKS.

TEL: (0753) 888447



Denon's very successful DR-M44 has now been updated by the inclusion of Dolby HX Pro, and a number of other improvements, to become the DR-M44HX. Linear crystal, oxygen-free copper cable now joins the independent (siamesed) record and playback heads to the amplifiers and there is an improved head block and positioning assembly. The counter now shows elapsed minutes and seconds, while both the range and resolution of the auto-tune circuits have been improved.

Otherwise, the DR-M44HX remains the same easy to use, gadget free, high-specification machine as before. It has automatic tape-type selection and high speed tape tuning to optimise performance for any blank tape.

A large fluorescent display panel houses the record level meters, the illuminated tape counter, and a variety of warning legends. Dolby B and C are included, plus a switchable MPX filter to allow response to reach 20kHz with Dolby operating, if desired. Microphone inputs are absent, as is now common with expensive decks; their manufacturers expect specialised mikes to be used, which usually have their own dedicated pre-amps.

LAB REPORT

Denon's dual capstan drive, fitted with a direct

drive motor on the '44HX, isn't of Nakamichi calibre, but is clearly superior to single capstan types. Low rate flutter (0.08%), in the range 10Hz to 24Hz, and a trace of capstan wow (0.04% at 6Hz) did exist, but these effects were at a lowish level. However, spectrum analysis clearly showed that the '44HX had more low rate flutter than the non-direct drive '33HX. Modulation noise with BASF CR-EII chrome tape was at an extremely low -45dB, due to freedom from high rate flutter and excellent tape-to-head contact.

Dolby HX Pro reduces bias in the presence of strong high frequency signals, in order to raise treble overload headroom. Certainly, it has improved them on the '44HX, but since chrome and metal MOLs have improved too, it appears that Denon have taken the opportunity to increase standing bias, improving midband headroom too.

The tape tuning system can now cope with BASF CR-MII — a super-chrome tape with very high treble output — and gave an almost-flat frequency response (though with an inevitable extreme-treble peak due to the nature of the tape). All other 'difficult' tapes were successfully tuned in, frequency response being adjusted to flatness from 30Hz to 20kHz within very fine 1dB limits. Record-gain was adjusted too, giving perfect Dolby tracking. Bias altered little.

Possibly due to claimed improved head alignment on the 'HX model, we found less to criticise in the replay-only frequency response than previously. But the DR-M44HX is still no Nakamichi in this area; it gets the response ruler flat to 8kHz, after which upper treble falls away to -6dB at 18kHz. Replay noise and hum, and transport speed were all beyond serious criticism.

SOUND QUALITY

Maxell MX gave a wonderfully smooth, silky sound, free of the edginess so common to metals. Some loss of clarity and insight were noticed against digital originals. Piano was not as solid as hoped; there was some pitch diffuseness. Sony ES gave a clearer, more up-front sound but with some slight top-end 'sizzle'. Both metals gave impressive results, all the same.

BASF CR-MII reached 'metal standards' easily, except on crescendos, where slight 'muddying' of the sound occurred. Otherwise, it combines the smoothness and confidence of MX with the clarity of Sony ES.

BASF LH-MI exhibited excellent clarity for a ferric tape, suffering mainly hiss — or treble splash at high levels if level was increased to minimise the hiss. Maxell XL-IS gave very similar results.

On musicassette, a piano (Ashkenazy, Decca digital) didn't have quite the solidity and impact expected. Pitch 'diffusion' was again noted and felt to be the cause. Transients were softened out and imaging could have been better. Quite a lot of inner detail was lost too. The '44HX is now very good with musicassettes — much better than the earlier '44 — but there is still room for improvement.

SUMMARY

The DR-M44HX has a broad range of features assisting good sound quality from cassette. Sensible design and layout make it easy to use as well. Automatic tape type selection and tuning ensures perfect tape compatibility with all types. Dual capstan drive successfully keeps wow, flutter and modulation noise down to low levels. Recording quality was excellent, musicassette sound quality reached a very high overall standard too, though there is still room for improvement here.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response	20Hz-11.0kHz	good
Speed accuracy	+0.2%	very good
Noise	-59dB	average

Record/replay using blank tape

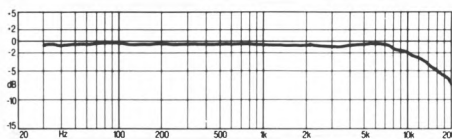
Frequency response, ferric	20Hz-20.0kHz	very good
Frequency response, chrome	20Hz-18.0kHz	very good
Frequency response, metal	20Hz-20.0kHz	very good
Stereo separation	-51dB	good
Distortion	0.7%	good
Noise	-53dB	good
Speed variation	0.04%	very good
Modulation noise	-45dB	very good
Flutter energy (band level)	-31dB	very good
MOL, ferric, 315Hz/10kHz	+4.5dB/-4.5dB	very good
MOL, chrome, 315Hz/10kHz	+2.5dB/-7.0dB	good
MOL, metal, 315Hz/10kHz	+6.0dB/+0.5dB	good

Input/output performance

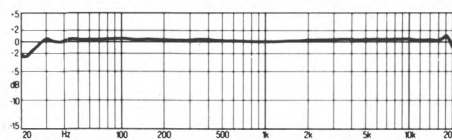
Line in (sensitivity/overload)	80mV/>3V
Mic input (sensitivity/overload)	None
Output	700mV
Typical price inc VAT	£400

REASSESSED

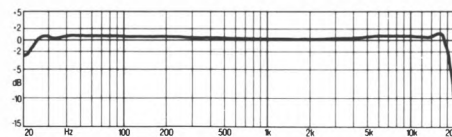
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



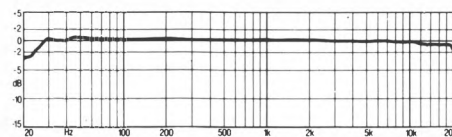
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

HI-FI CHOICE

1986/87 SERIES

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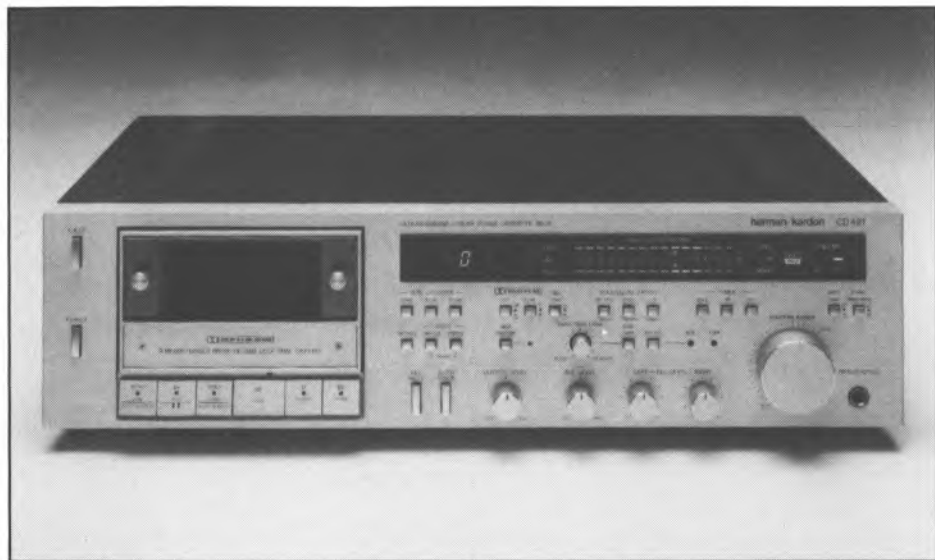
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CONTINUED

HARMAN-KARDON CD491

HARMAN (AUDIO) UK LTD, MILL STREET, SLOUGH, BERKS SL2 5DD.

TEL: (0753) 76911



Harman-Kardon's '491 is a large, sophisticated and button-covered deck. The transport uses dual capstan drive for improved speed stability and independent (siamesed) record and replay heads provide off-tape monitoring when recording. Manual bias adjustment provides tape tuning, but tape type selection was not automatic.

The record level meters set 0VU close to Dolby level and two wide-range LED displays cover -30dB to $+10\text{dB}$ with good resolution. The meters also have selectable peak hold and treble equalisation emphasis options.

LAB REPORT

Well set bias (detent position) and the presence of HX Pro ensured respectable recording tape overload figures at low/middle and high frequencies respectively. Metal tape in particular took a lot of level, at $+6\text{dB}$ above 0VU. This performance allows the CD491 to minimise the muddling and dullness that occurs with high

recording levels, especially with ferric tape.

Record equalisation wasn't quite right for IEC tapes, necessitating a bias increase to suppress rising treble. This affected treble overload (saturation) little and successfully 'flattened' most tapes — but not awkward super-tapes like Maxell XL-IS and BASF CR-MII, which still have excessive treble and are not really compatible.

Replay frequency response was flat to 10kHz and then shelved downward slightly at higher frequencies. Obviously, the latest (1981) replay characteristic has been used, resulting in even tonal balance and healthy treble from musicassettes. Some Dolby B replay tracking error will dull low level music.

The replay amplifier had acceptably low hiss, but hum (and its harmonics) hovered around -60dB , which is not especially low. It was just audible at high gain with low level recordings. Speed accuracy was fine and speed stability excellent, on replay only and in record-replay. Flutter was well suppressed by the dual capstan

transport, analysis revealing a trace of capstan wow at 6.5Hz.

SOUND QUALITY

Choice of tapes for the CD491 is more critical than usual, because of its record-equalisation peculiarities. Sony ES metal gave fine results without bias tuning. TDK SA and Maxell XL-IIIS both proved compatible in the 'chrome' position, suffering very little treble 'softening' compared to metal. Fine detail was well preserved. A non-Dolby recording on BASF CR-EII (chrome) tape proved quiet to the point where only slight and very even background hiss was audible and not annoying. Fine transient definition was obtained on tests carried out with noise reduction circuits switched out.

Ferric tapes generally sounded brighter and less fluffy in treble quality than usual. They performed relatively well in subjective terms and we felt the CD491 made unusually good use of them.

SUMMARY

Quality of musicassette reproduction and recordings reached a very high standard, but some super-tapes are not compatible and most European IEC-aligned tapes need bias tuning. Otherwise, thanks to its broad range of facilities, this deck balances flexibility in use with an impressive level of performance. Now also available in black, it is certainly recommended.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response	30Hz-20.0kHz	very good
Speed accuracy	+0.5%	good
Noise	-58dB	average

Record/replay using blank tape

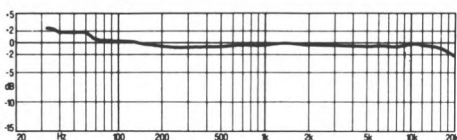
Frequency response, ferric	20Hz-20.0kHz	very good
Frequency response, chrome	20Hz-16.0kHz	very good
Frequency response, metal	20Hz-20.0kHz	very good
Stereo separation	-53dB	good
Distortion	1.0%	good
Noise	-53dB	good
Speed variation	0.04%	very good
Modulation noise	-41dB	good
Flutter energy (band level)	-32dB	very good
MOL, ferric, 315Hz/10kHz	+3.0dB/-1.0dB	good
MOL, chrome, 315Hz/10kHz	+1.0dB/-5.0dB	good
MOL, metal, 315Hz/10kHz	+6.0dB/+1.5dB	good

Input/output performance

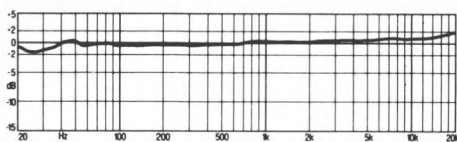
Line in (sensitivity/overload)	40mV/>3V
Mic input (sensitivity/overload)	1.3mV/64mV
Output	450mV
Typical price inc VAT	£599

REASSESSED

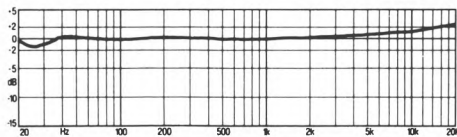
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



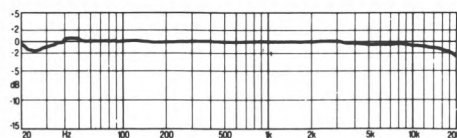
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

HITACHI DW800

HITACHI SALES (UK) LTD, HITACHI HOUSE, STATION ROAD, HAYES, MIDDLESEX.

TEL: 01-848 8787



Double-mechanism 'dubbing' decks will have an appeal of their own to some users. The Hitachi D-W800, as well as offering the basic facility of conveniently copying the contents of one cassette on to another, also incorporates various other functions. These include mixing line or microphone input with the pre-recorded tape, and an editing facility so that the machine can be programmed to replay the pre-recorded cassette in any order, thus altering the track order on the copy. Dubbing can also be done at twice normal speed, with some loss in high frequencies.

Tape selection is automatic only (no manual over-ride) and the deck incorporates Dolby B and C noise reduction systems. (Old Hitachi ME metal tapes without sensing slots cannot be recorded properly on this deck, due to auto-tape selection.)

A long play function allows two tapes to be played back alternately, one playing while the other rewinds. Record level controls only affect line and the (mono) microphone level, the output from the playback cassette being adjusted by the stereo ganged tape-level control which

should be left in a centre 'click' position during normal dubbing.

Blue fluorescent record-level meters are set to approximately Dolby level. They purport to show peak levels, but low frequencies under-read badly, a drum at 0VU only registering -10dB on the display, for example. This induces over recording with bass-heavy material.

Although housed in a metal case and appearing robust enough, the deck looks and feels a little 'plasticky'. Logic controls allow it to operate smoothly and quietly though, which was satisfying. Both tape compartments have back-lighting, but a single illuminated tape counter worked with the recording section only.

LAB REPORT

The replay response of both sections of this deck was poor, suffering steadily falling treble above 1kHz and slow bass roll-off below 200Hz, culminating in sudden bass fall at 60Hz. Dolby action magnified the treble error, as it always does, so the problem was worse at low levels. This will seriously dull the treble quality of pre-recorded cassettes and make them sound vague and hazy.

Both transports ran 1% fast, which is just acceptable but speed stability was very good for a budget product, total flutter sideband energy being equivalent to -25dB on both sections.

Whilst midband and high frequency distortion figures were normal, under-reading on the record-level meters resulted in a massive 40% distortion on bass signals recorded at 0VU, using metal or ferric tape. Obviously, the heads are not happy with high level low frequency signals, and the problem is compounded in practice by the under-reading meters.

Noise levels were low with all tape types. Erase noise was low and erase efficiency was unusually good with metal tape. Bias levels were sensibly set to give a reasonable balance between midband and treble maximum output levels. Additionally, frequency response with ferric, chrome and metal tapes proved reasonably flat.

SOUND QUALITY

Metal tape had a slightly dry, 'brittle' sound and there was a lack of deep bass. However, piano and organ were reproduced without speed problems. 'Splashy' sibilants were noticed on speech. We specifically listened for the subjective impact of bass distortion, but found it was not particularly annoying. A rather 'brittle', thin quality was noticed on Hitachi SX 'chrome' tape too, plus sibilance 'splash.' Results were otherwise acceptable. Ferric tape was also on the harsh side but tonal balance sounded even.

Replay quality was poor. There was lack of bass, 'haziness' and lack of clarity at low levels. Vocals sounded muffled.

SUMMARY

The *DW800* was a competent dubbing deck, and would have received praise but for its replay performance, which on our sample and in our view was very poor. All tape copies are affected by this.

TEST RESULTS

Replay of pre-recorded muscassettes

Frequency response _____ 60Hz-6kHz poor
Speed accuracy _____ +1.0% average

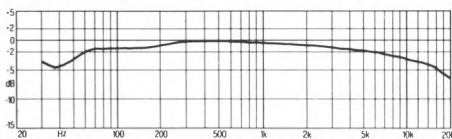
Record/replay using blank tape

Frequency response, ferric _____ 40Hz-17kHz very good
Frequency response, chrome _____ 40Hz-17kHz very good
Frequency response, metal _____ 45Hz-18.5kHz very good
Stereo separation _____ -53dB good
Distortion _____ 15% very poor
Tape hiss, ferric _____ -69dB good
Tape hiss, chrome _____ -71dB very good
Tape hiss, metal _____ -69dB good
Speed variations (wow and flutter) _____ 0.06% good
Modulation noise _____ -38dB average
Flutter energy (band level) _____ -28dB good
MOL, ferric, 315Hz/10kHz _____ +3dB/-10.0dB average
MOL, chrome, 315Hz/10kHz _____ 0dB/-8dB average
MOL, metal, 315Hz/10kHz _____ +2dB/-3dB poor

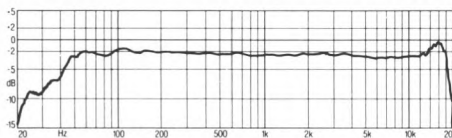
Input/output performance

Line in (sensitivity/overload) _____ 110mV/-V
Mic input (sensitivity/overload) _____ 0.8mV/50mV
Output _____ 500mV
Typical price inc VAT _____ £240
REASSESSED

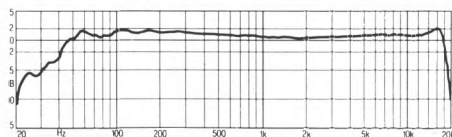
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



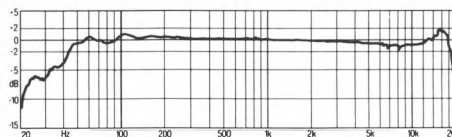
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)

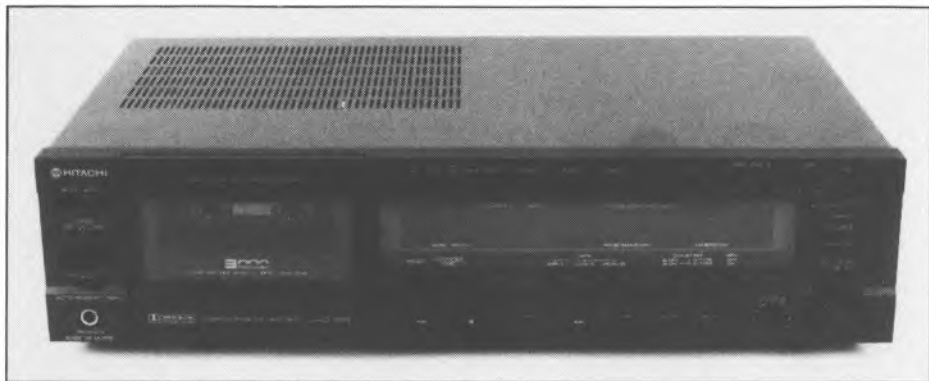


Type IV (metal)

HITACHI D-909

HITACHI SALES (UK) LTD, HITACHI HOUSE, STATION ROAD, HAYES, MIDDLESEX UB3 4DR.

TEL: 01-848 8787



The D-909 is a very difficult deck to understand, since Hitachi have attempted to offer every possible permutation of the most important facilities seen in cassette decks. Although a laudable aim, the result seemed a conceptual nightmare to use, and much of what it offers may remain beyond the understanding of most users.

The deck has automatic tape tuning (ATRS), in which bias can be pre-set 'std' 'high' or 'low', so slightly altering the balance between high and low frequency overload levels. Set high, there will be plenty of low frequency headroom with ferric and chrome tapes in particular, but diminished treble headroom — and vice-versa with low bias. (Metal tape varies little in response to bias variation, however.) Automatic tuning sets response 'flat' with blank tapes, but there's also an entirely manual tuning system too. Heaven knows why as only one system is really necessary. Record-EQ is used to alter frequency response — a theoretically correct way of going about things — and there are sensitivity adjusters as well.

Yet in spite of all this complexity, tape selection is manual instead of automatic which is amazingly inappropriate for a top model. The D-909 is a three-head machine, so recordings can be checked for quality (monitored) as they

are made. It has a dual-capstan transport to achieve good speed stability.

LAB REPORT

The ATRS system resulted in a nearly-flat frequency response with ferric and chrome tapes, but not with metal tape, where rising treble is a problem. (This is the third D-909 I have tested that exhibits such a problem.) To avoid this effect 'fixed' mode must be selected to eliminate the ATRS, and then the record EQ can be adjusted. This was the best way of tuning ferrics and chromes too, so the D-909 automatics didn't manage very well.

Speed stability of the dual-capstan transport proved very good, the spectrum analysis showing low drift, wow and flutter. However, Hitachi's Uinitorque direct drive motor introduces some low frequency cogging disturbance below 25Hz though there are attempts to filter this out; two flutter peaks may be seen in the analysis.

The head showed a very limited ability to cope with metal tape, managing only +1.2dB MOL compared with an expected 3–4dB. Distortion was higher than usual as a result, especially at low frequencies. Overload levels with ferric and chrome tape were mediocre also, but here low bias was the cause, with the counter benefit of raising the overload ceiling at high frequency.

Replay frequency response displayed falling treble, measuring -1.7dB at 10kHz , but there was also some rise at higher frequencies, to -1.3dB at 18kHz . The low frequency roll-off, due to the filtering mentioned earlier, is also seen.

SOUND QUALITY

Using ATRS, metal tapes (TDK MA-X and Maxell MX) had noticeably bright treble, sounding quite sharp at times, but not offensive. Manual tuning got around this problem. Resultant recordings were good, if a little uneven tonally. Slight pitch 'wateriness' was noted with a piano recording made on BASF CR-E11 tape, plus tonal dullness with ATRS tuning. Manual tuning rectified the problem. TDK AD-X ferric tape gave good results on the D-909, with well defined transients.

Musicassette replay quality proved very respectable on this sample. There was some obvious softness and dullness, but otherwise dynamics were well reproduced with a fair sense of clarity. (Two previous samples had proved mediocre in this area).

SUMMARY

The D-909 is a complex cassette deck having a dual-capstan transport, three heads and both automatic and manual tape tuning systems. Recording quality on all tape types reached a high standard, but only after careful manual tuning. Musicassette replay quality was better than usual.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ $50\text{Hz}-18.0\text{kHz}$ good
 Speed accuracy _____ $+1.0\%$ average
 Noise _____ -62dB good

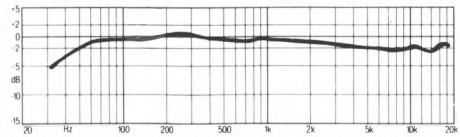
Record/replay using blank tape

Frequency response, ferric _____ $30\text{Hz}-17.0\text{kHz}$ very good
 Frequency response, chrome _____ $30\text{Hz}-20.0\text{kHz}$ very good
 Frequency response, metal _____ $30\text{Hz}-10.0\text{kHz}$ good
 Stereo separation _____ -40dB poor
 Distortion _____ 2.2% very poor
 Noise _____ -53dB good
 Speed variation _____ 0.04% very good
 Modulation noise _____ -42dB good
 Flutter energy (band level) _____ -33dB very good
 MOL, ferric, $315\text{Hz}/10\text{kHz}$ _____ $+2.8\text{dB}/-7.0\text{dB}$ average
 MOL, chrome, $315\text{Hz}/10\text{kHz}$ _____ $+0.8\text{dB}/-7.0\text{dB}$ average
 MOL, metal, $315\text{Hz}/10\text{kHz}$ _____ $+1.2\text{dB}/-7.0\text{dB}$ very poor

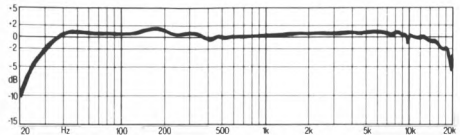
Input/output performance

Line in (sensitivity/overload) _____ $78\text{mV}/>3\text{V}$
 Mic input (sensitivity/overload) _____ None
 Output _____ 460mV
 Typical price inc VAT _____ $\pounds 350$

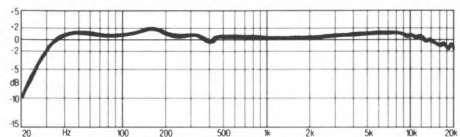
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



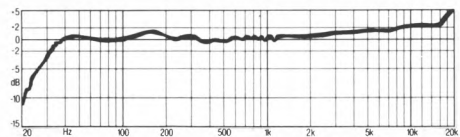
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



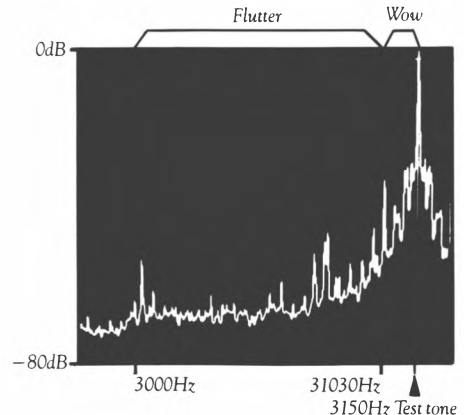
Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)



HITACHI DW450

HITACHI SALES (UK) LTD, HITACHI HOUSE, STATION ROAD, HAYES MIDDLESEX.

TEL: 01-848 8787



Very much a budget dubbing deck, the W450 has a cheap feel to it. However, overall styling and ergonomics are sensible. For example, symbols are printed on the transport controls and legends provide extra clarity. Elsewhere legends are clear, and their gratuitous use has been kept to a minimum.

The clanky mechanical transport accepts a wide variety of commands. Automatic facilities include dubbing start, continuous play mode, and tape selection on the playback-only deck. Manual selection uses twin combination-buttons for the second recording deck.

Hitachi have cut costs by providing only Dolby B, which gives 10dB noise reduction compared with Dolby C's 19dB. The peak level indicator has an adequate LED display with reasonable range and resolution. Mike inputs are fitted for live recording purposes.

LAB REPORT

Although the clanky mechanical behaviour of this deck and the crude feel of its controls impart an air of cheapness, basic speed stability was better than expected — but that's still not to say exceptional. Both transports suffered wow at around 0.1% plus a fair bit of flutter. Such wow levels may usually be heard on critical piano programme, making sustained notes sound

a bit 'drunken', but only listening tests can confirm this.

An overall distortion figure of 3.6% conceals a specific problem at low frequencies, head saturation resulting in 9% distortion with metal tape. This level of bass distortion is not uncommon in budget cassette decks, and results in a 'light' bass quality, due to a strengthening of harmonics at the expense of the fundamental. The effect will be made worse in practice by a record level meter that reads too low, encouraging over-recording with bass heavy music.

Overload ceiling tests (MOLs and SATs) showed that Hitachi have fitted a reasonable head, more capable than some at dealing with metal tape. Bias has been set low, giving very good treble saturation (overload) figures for all three tape types.

Frequency response of recordings made on all three tape types was reasonably flat, so the deck gave a satisfactory performance.

Replay frequency response was curious, showing falling bass but rising treble. It is likely to result in a 'light' sound with pre-recorded tapes.

SOUND QUALITY

As expected, musicassettes sounded thin and 'pinched', with little bass to speak of, while the subjectively compressed range gave a sound dec-

idedly lacking in 'punch'.

Thanks to a good head, Maxell MX (metal) sounded clean and unmuddled at high levels, but boosted treble dominated the overall sound, often thinning it to the point where it became slightly unpleasant. Hum was distinctly noticeable on chrome (BASF CR-EII), and piano pitch tended towards vagueness and lacked solidity, the latter being a result of wow. With TDK SA the sound was again treble dominated, and the overall range sounded compressed with some 'grittiness', made noticeable by strong sibilance. On ferric (TDK AD) treble sounded bright and 'gritty' to the point of nastiness. Transients were softened and compressed.

The lack of dynamic range noted on all tape types was exaggerated during dubbing. At both high and normal speeds, boosted treble and a notable lack of bass gave a severely thinned, subjectively monotonic quality devoid of 'punch'.

SUMMARY

The W450 has a rather crude, cheap 'feel' to it immediately noticeable when using the clanky mechanical transport and the dual concentric recording level control, and by the lack of useful displays. Sound quality was treble-dominated on all tape types, and the resultant subjective lack of balance and range was especially apparent in the results of dubbing, which proved weak and unimpressive.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 100Hz-17.0kHz average
 Speed accuracy _____ +0.5% good
 Noise _____ -54dB very poor

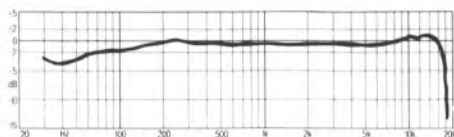
Record/replay using blank tape

Frequency response, ferric _____ 25Hz-15.0kHz very good
 Frequency response, chrome _____ 25Hz-14.0kHz good
 Frequency response, metal _____ 25Hz-15.0kHz very good
 Stereo separation _____ -4.5dB average
 Distortion _____ 3.6% very poor
 Noise _____ -53dB good
 Speed variation _____ 0.10% very good
 Modulation noise _____ -37dB poor
 Flutter energy (band level) _____ -24dB average
 MOL, ferric, 315Hz/10kHz _____ +1.5dB/-5.0dB poor
 MOL, chrome, 315Hz/10kHz _____ +2.0dB/-6.0dB very poor
 MOL, metal, 315Hz/10kHz _____ +1.5dB/+0.5dB very poor

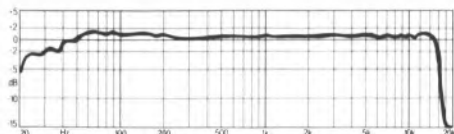
Input/output performance

Line in (sensitivity/overload) _____ 70mV/>3V
 Mic input (sensitivity/overload) _____ 1mV/30mV
 Output _____ 500mV
 Typical price inc VAT _____ £140

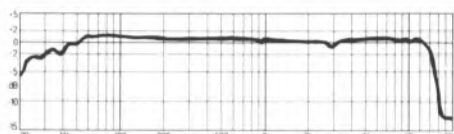
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



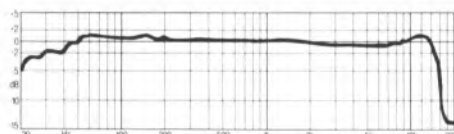
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

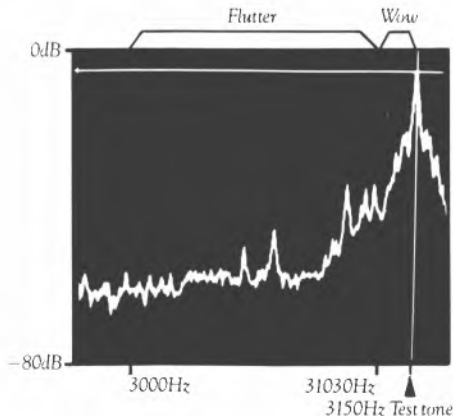


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



RECOMMENDED

JVC KD-X2

JVC (UK) LTD, JVC HOUSE, 12 PRIESTLEY WAY, ELDONWALL TRADING ESTATE, STAPLES CORNER,
LONDON NW2 7AF TEL: 01-450 3280



The JVC KD-X2 is a budget machine, carefully built to balance performance and economy of construction. The record level meters use individual LEDs and transport control buttons are a conventional mechanical linked array which JVC have called 'logic control', although there is no electronic logic at all, only cross-linked mechanical actions. Such mechanical arrangements are common and do allow certain awkward commands to be carried out, like fast forward from fast reverse. However, I feel that calling them 'logic controls' is stretching the definition somewhat.

JVC fit a 'music scan' system on this deck which works by searching for the gaps between tracks. Dolby B and C noise reduction systems are provided, and selected by a rather small lever switch, as is tape-type. The KD-X2 was fairly easy to use, but had a somewhat fussily styled fascia.

LAB REPORT

The head contour of this deck proved inferior to many, with its frequency response undulations starting at 150Hz. Replay response displayed

slight treble shelving to 10kHz, after which output falls away. This effect was slight, however, and by budget standards the KD-X2 was well set-up to get correct tonal balance from musicassettes, without the extremely dull, vague sound that is so common. Replay noise was adequately low, and produced just very slightly hissy recordings.

Replay speed measured 2% fast, which is a discernible error if the programme has previously been heard at the correct speed. Replay speed stability was adequate, and record/replay speed instability performance figures were quite adequate; the 'X2 was as speed-stable as most good budget machines. Nakamichi standards can't be expected at this price!

Bias adjustment of the KD-X2 was well balanced, giving around +3dB more treble headroom with ferric and chrome tapes. Sensitivity was accurately set for commercial tapes too, and all frequency responses were fairly flat.

SOUND QUALITY

Metal tape (TDK MA and JVC ME) gave a slightly 'glassy' hard sound with a degree of 'pitching' with sibilance. Wow slightly

corrupted the sound of harmonica and organ.

Treble 'feathered' with TDK SA and there was again a 'glassy' quality. Wow was noticed as a 'watery' quality, but we felt the overall result was fair.

Ferric tape gave very even tonal balance, but slight loss of treble detail. Cymbals were a bit 'swishy'. In general though, we felt the result was good.

Over-large, plummy bass was obvious with musicassettes and low level fine detail was weak. Being evenly balanced across the midrange though, we felt the character wasn't unpleasant and there was surprisingly convincing stereo. Generally, a nice sound.

SUMMARY

A fairly basic budget deck with Dolby B and C noise reduction, the *KD-X2* uses LEDs rather than fluorescent displays for record level metering, and has mechanical transport controls. Although these transport buttons are mechanically interlinked, they do not in our view justify the term 'logic control'.

The performance strength of the *KD-X2* was in tape matching, and this is important with regard to the sound quality of recordings. Musicassette replay quality was judged good because of its clarity, but replay speed was too fast. Despite some weaknesses, then, the *KD-X2* must be Recommended at the price.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 35Hz-12.0kHz good
 Speed accuracy _____ +2.0% very poor
 Noise _____ -60dB good

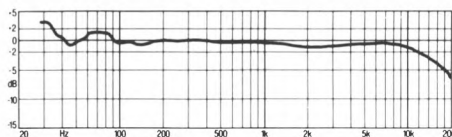
Record/replay using blank tape

Frequency response, ferric _____ 22Hz-14.0kHz good
 Frequency response, chrome _____ 22Hz-15.0kHz very good
 Frequency response, metal _____ 22Hz-15.0kHz very good
 Stereo separation _____ -49dB average
 Distortion _____ 0.6% good
 Noise _____ -53dB good
 Speed variations _____ 0.12% average
 Modulation noise _____ -39dB average
 Flutter energy (band level) _____ -29dB good
 MOL, ferric, 315Hz/10kHz _____ +4.0dB/-6.5dB good
 MOL, chrome, 315Hz/10kHz _____ +0.0dB/-6.5dB average
 MOL, metal, 315Hz/10kHz _____ +3.0dB/-0.0dB average

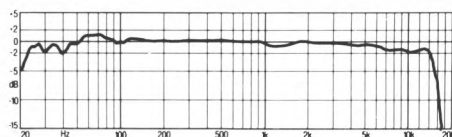
Input/output performance

Line in sensitivity/overload _____ 75mV/->3V
 Mic input sensitivity/overload _____ 0.34mV/22mV
 Output level _____ 300mV
 Typical price inc VAT _____ £99
 REASSESSED

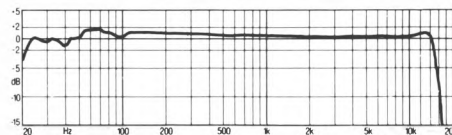
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



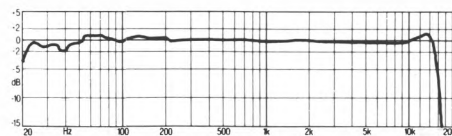
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

JVC KD-V220

JVC (UK) LTD, JVC HOUSE, 12 PRIESTLEY WAY, ELDONWALL TRADING ESTATE, STAPLES CORNER,
LONDON NW2 7AF. TEL: 01-450 3282



JVC's budget cassette decks have invariably been good value. The KD-V220 is a low-cost basic design fitted with Dolby B and C noise reduction systems. The satin black front panel looks quite busy, since it carries a number of white legends, a few warning lights, a considerable web of white styling lines, plus the usual array of controls and buttons. Tape type selection is manual, using a rather small lever switch, and Dolby selection is similar.

JVC manage to include comprehensive logic control at the price, with punch-in recording and rewind direct from record. The press-plates were a bit stiff, causing the deck to slide backward on shiny surfaces. A 'shift' key modifies their role, providing search facilities like 'Index-scan' and 'Blank-skip'.

The bright blue fluorescent record meters were easy to see and followed musical peaks well. The visual clutter of the fascia made finding switches a trifle awkward, and automatic tape type selection would have been more worthwhile than some of the gadgets, I feel, but the logic was good at the price.

LAB REPORT

Bias had been set high, favouring mid-band distortion and overload performance on recordings, at the expense of treble overload

(saturation), which was poor. This trade-off produces messy treble. Bias ratios for three tape types were inappropriate for European (IEC) tapes. With IEC IV (metal) just about 'flat', IEC Type I (ferric) has falling treble. Accentuated by Dolby action, the result will be a dull sound with ferric tapes, except those with very high treble sensitivity, like Maxell XL-IS. Sensitivity was +2dB too high as well. Most pseudo-chromes, like TDK SA and Maxell XL-II, will match well.

Metal tape matching was problematic. The treble peak visible in the graph with IEC IV tape becomes a pronounced treble rise with tapes like TDK MA and Sony ES. Dolby action magnified this considerably on the review machine, since Dolby tracking was poor due to incorrect sensitivity setting again (+2dB error with MA), giving excessive treble under test. Maxell MX was the best match, but wideband noise testing of spectral balance whilst level-tracking showed some treble emphasis even with this tape. Record and replay amps produced very little noise. Hiss on recordings, using Dolby C, measured -74dB, but there was slight hum that measured -60dB on the more audible 100Hz component as well as at 50Hz. I rarely discuss cassette decks' mike amps, even when they are tested. JVC's gets a mention here because it overloaded at 10mV (7% distortion) instead of around 30mV, like most. Sensitivity was low too,

so a high output mike is needed despite the risk of overload.

The transport was reasonably flutter free but exhibited rapid capstan warble (wow) at a rate of 7Hz. Replay frequency response was quite well maintained to high frequencies, and Dolby B replay tracking was accurate as a result. Musicassettes should not sound dull.

SOUND QUALITY

With TDK MA (metal) a bright sound was obvious, but an absence of grittiness and 'blasting' probably due to the low flutter of this machine made it acceptable, at least in the short term. Maxell MX had a more even tonal balance and provided a good all round performance. Slight hum was just noticeable at high volume, plus wow on critical program. TDK SA (chrome) gave a slightly dull and warm tonal balance with treble loss due to saturation. Transients, as with strummed steel-string guitar, were blurred, as were cymbal sounds. There was general loss of definition. Wow added to the blurring and became obvious with critical programme such as piano. Ferric (TDK AD) had a warm tonal balance and lacked both detail and definition. Wow again smeared the performance and was noticed with organ and piano in particular.

Musicassettes had fine tonal balance and well-defined treble, noticeable with harpsichord, guitar and cymbals. There was plenty of treble at low levels too. Again wow was noticed, and this time we felt that piano and organ lovers might object very strongly to it.

SUMMARY

Despite a fairly congested front panel, the KD-V220's comprehensive logic-controlled transport made operation easy enough. Scan and search facilities and Dolby B and C are included, amounting to quite a lot for the price.

Measured performance was found a bit awry in various areas that affect recording quality, and wow proved disconcerting at times. Reasonable results were obtained with chrome tapes, ferrics sounded dull and lifeless, and metals somewhat bright, Maxell MX being a best match. Musicassettes were handled successfully — a good point.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response	251Hz-15.0kHz	very good
Speed accuracy	+1.0%	average
Noise	-62dB	very good

Record/replay using blank tape

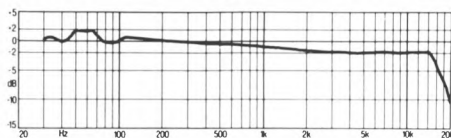
Frequency response, ferric	201Hz-14.0kHz	good
Frequency response, chrome	201Hz-16.0kHz	very good
Frequency response, metal	231Hz-16.0kHz	very good
Stereo separation	-49dB	average
Distortion	1.1%	average
Noise	-55dB	very good
Speed variation	0.15%	average
Modulation noise	-35dB	very poor
Flutter noise (band level)	-29dB	good
MOL, ferric, 315Hz/10kHz	+4.5dB/-9.0dB	average
MOL, chrome, 315Hz/10kHz	+1.0dB/-10.0dB	average
MOL, metal, 315Hz/10kHz	+4.0dB/-2.0dB	very poor

Input/output performance

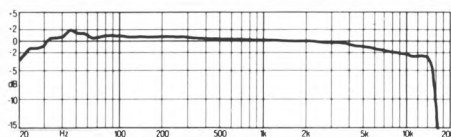
Line in (sensitivity/overload)	75mV/>>V
Mic input (sensitivity/overload)	0.4mV/10mV
Output	300mV
Typical price inc VAT	£100

REASSESSED

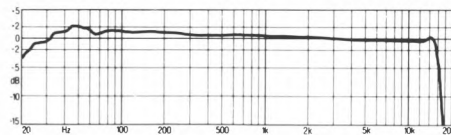
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



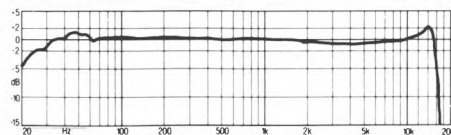
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

JVC KD-VR320

JVC (UK) LTD, JVC HOUSE, 12 PRIESTLEY WAY, ELDON WALL TRADING ESTATE, STAPLES CORNER,
LONDON NW2 7AF TEL: 01-450 3282



This is a low-cost auto-reverse deck, with reverse recording — achieved by use of a rotating head platform. The VR320 does not have optical leader-tape sensing for fast reverse, so unattended recordings of an entire cassette will have a gap of around ten seconds missing at the end of the first side, a minor drawback shared with many other decks. The transport buttons were small, square panels that proved easy to tap with a finger and they needed only very light pressure for easy operation.

Very comprehensive logic accepts some of the most awkward commands, like 'punch-in' recording and fast reverse direct out of record mode. In contrast, the two interdependent buttons for tape selection are small, have very small legends and so are difficult to use. Attractive bright orange fluorescent record level meters did a good job of indicating music peaks clearly. Dolby B and C noise reduction systems are included, plus auto-start from an external timer.

LAB REPORT

Replay frequency response, which affects music-cassette reproduction, was flat (ignoring the minor -1dB shelving) to 10kHz, after which output fell away slowly. Freedom from reverse

azimuth error gave an identical characteristic in reverse, and there was no change or instability in output after repeated reversals. The machine was well aligned.

Spectral analysis of replay noise from 10kHz to 30kHz revealed an mpx filter in the replay path — a strange ruse, adopted I suspect to obtain improved noise figures. Lacking supersonic components above 16kHz, replay noise (CCIR weighted) was a very low -63dB (-72dB Dolby B). Recording noise was lowered by a dB or so, and hum was also notably low.

The transport ran fast by 1%, forward and reverse, which is just acceptable. Speed stability was relatively good, wow being distributed rather than concentrated into one objectionable component. Flutter was well suppressed too. Performance in reverse was similar to that going forward, and replay-only showed similar characteristics.

Peak record level has been kept down to -2dB below Dolby flux, which helped toward the low 0VU average distortion figure of 0.5% — high bias also played a part here. Treble overload (saturation) figures were poor and the head had metal tape, giving poor overload results (MOL and saturation).

The microphone amplifier overloaded pre-

maturely at just 10mV (for 7% distortion) — most manage 30mV or so. Recording frequency responses were gratifyingly flat with all tape types. Dolby tracking was poor, however, upsetting these results at low levels.

SOUND QUALITY

TDK MA metal gave a rich and 'ponderous' sound. It was unpleasant, but lacked bite and attack. Speed stability was disappointing on critical piano and organ programme. We found this tonal balance tends to disguise flutter and distortion problems, but it also generates a somewhat bland and unexciting sound. Tonal balance with TDK AD ferric tape gave a pleasantly euphonious result, with neutral tonal balance tinged by softening due to saturation.

The deck again gave neutral tonal balance with musicassettes, while good Dolby tracking brought out low level fine detail well. The sound had bite and was enjoyable. Wow and flutter seemed innocuous, except when listening to organ and piano when, after a while, its 'dirtying' effects became a bit wearing.

SUMMARY

The KD-VR320 is a well built and finished auto-reverse deck, but lacks quick auto-reverse. Its transport has full logic control and light, easy-to-use press-plates. Uncommonly awkward tape selector buttons were annoying to use. Measured performance was good, except for early overload in the mike amps, poor utilisation of metal tape performance and limited treble with ferric and chrome tapes. Recording quality with all tape types was good in the sense that it was inoffensive, but not exceptional. Musicassettes were handled very well compared with many other decks.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-16.0kHz very good
 Speed accuracy _____ +1.2% average
 Noise _____ -63dB very good

Record/replay using blank tape

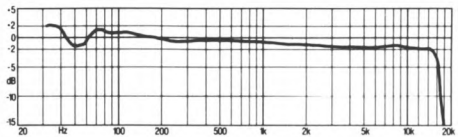
Frequency response, ferric _____ 20Hz-15.0kHz very good
 Frequency response, chrome _____ 20Hz-16.0kHz very good
 Frequency response, metal _____ 20Hz-16.0kHz very good
 Stereo separation _____ -49dB average
 Distortion _____ 0.5% very good
 Noise _____ -55dB very good
 Speed variation _____ 0.10% good
 Modulation noise _____ -39dB average
 Flutter energy (band level) _____ -28dB good
 MOL, ferric, 315Hz/10kHz _____ +4.0dB/-9.0dB average
 MOL, chrome, 315Hz/10kHz _____ +0.0dB/-8.0dB average
 MOL, metal, 315Hz/10kHz _____ +3.0dB/-2.5dB very poor

Input/output performance

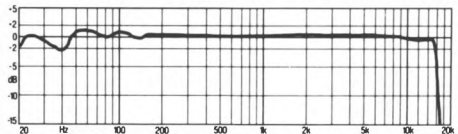
Line in (sensitivity/overload) _____ 85mV/>3V
 Mic input (sensitivity/overload) _____ 0.35mV/10mV
 Output _____ 300mV
 Typical price inc VAT _____ £149

REASSESSED

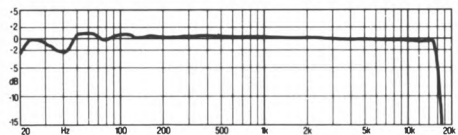
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



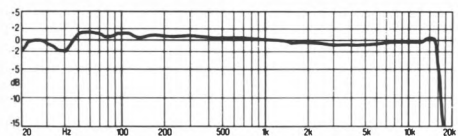
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

JVC TD-W20

JVC (UK) LTD, 12 PRIESTLEY WAY, ELDONWALL TRADING ESTATE, STAPLES CORNER, LONDON NW2 7AE.
TEL: 01-450 3282



This budget dubbing deck has a distinctly unusual style and a rather cheap 'feel'. The mechanical transport is reasonably quiet and can 'punch-in' record, though it won't accept other unusual commands such as fast forward direct to fast rewind. The playback-only deck (A) has automatic tape selection, but the dual-role (recording and playback) deck (B) has manual selection with twin push-button combination switching. This was as confusing as usual, and lacked any form of warning display. Similarly Dolby B and C lacked any display so the possibility of operator errors is very real.

However, the push button dubbing controls do have display for both high and normal speeds, and dubbing is manually started. The LED peak level meter has an average range (-10 to +6) with 'go' and 'no-go' areas in yellow and red respectively, but resolution is poor.

LAB REPORT

Whilst a number of dubbing decks showed an unusual rising treble replay response, the TD-W20 has a falling treble, much like other cassette decks from this company. The two transports showed different degrees of loss at 10kHz the playback-only was -1dB, while the record/play was a less acceptable -2.5dB.

The TD-W20 heads were not quite up to the company's usual high standard, but managed to turn in respectable midband overload figures (MOL315), albeit at the expense of poor treble overload with metal tape (-2dB at 10kHz). However, metal tape still gives a pretty useable +3dB/-2dB MOL/SAT balance, which allows high recording levels to be used.

Combine these reasonably high recording levels with a lower than usual noise floor and you end up with fine dynamic range — a feature of the TD-W20 and a strong point with most JVC decks. However, this is partly achieved by insufficient replay treble boost (EQ).

Speed stability of the playback-only transport (A) was respectable, speed accuracy was good and total wow and flutter measured 0.08% (DIN-weighted). The recording transport was less impressive; despite very little drift, bad capstan wow is seen in the spectrum analysis.

Recording frequency response proved acceptably flat with all three tape types, but a dub copy (metal-to-metal) exhibited +5dB treble lift at 12kHz, which will add a 'string' to the sound.

SOUND QUALITY

Falling treble seen in the replay response graph was strongly evident with music cassettes, which sounded warm, flat and bland with no sense of dynamic 'punch'.

Metal (Maxell MX) sounded unexpectedly weak, with bright, dominant treble. However, clarity remained good at high levels, with no blurring or messiness. Capstan wow was distinctly noticeable on chrome (BASF CR-E-II), corrupting piano notes to the point of 'drunkenness'. Pitch was weak and 'watery' and easily muddled at high levels. Tonal balance on TDK SA was bright and lightweight with a slender dynamic range that compromised instrumental separation. Ferric (TDK SA) sounded surprisingly 'flaccid', with poor tonal definition, everything seemingly squeezed into the midband. This 'softness' extended to transients so that electronic rock lost a great deal of impact.

As predicted in the lab report, dubbing results were poor at both high and normal speeds, severely falling treble giving a flat, 'watery' sound, 'softening' transients to the point where they became almost non-existent.

SUMMARY

Even for a budget dubbing deck the TD-W20 is not impressive. The lack of displays for tape type or Dolby is likely to cause user errors especially during dubbing itself. Despite a reasonable head, falling treble response gave musicassettes the customary flaccidness. While metal and ferric sounded thin, capstan wow severely affected chrome. Altogether a disappointing combination of design and performance.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-8.0kHz average
 Speed accuracy _____ +0.6% good
 Noise _____ -61dB good

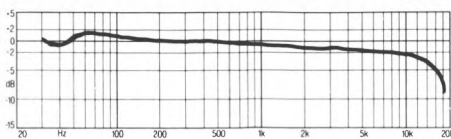
Record/replay using blank tape

Frequency response, ferric _____ 20Hz-15.0kHz very good
 Frequency response, chrome _____ 20Hz-16.0kHz very good
 Frequency response, metal _____ 20Hz-16.0kHz very good
 Stereo separation _____ -45dB average
 Distortion _____ 0.5% very good
 Noise _____ -55dB very good
 Speed variation _____ 0.12% very good
 Modulation noise _____ -39dB average
 Flutter energy (band level) _____ -23dB average
 MOL, ferric, 315Hz/10kHz _____ +3.0dB/-7.0dB good
 MOL, chrome, 315Hz/10kHz _____ -2.0dB/-8.0dB very poor
 MOL, metal, 315Hz/10kHz _____ +3.0dB/-2.0dB very poor

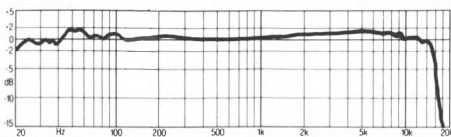
Input/output performance

Line in (sensitivity/overload) _____ 100mV/>3V
 Mic input (sensitivity/overload) _____ 1mV/50mV
 Output _____ 320mV
 Typical price inc VAT _____ £159

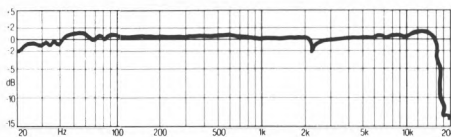
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



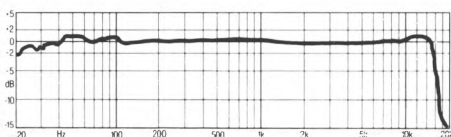
OVER ALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

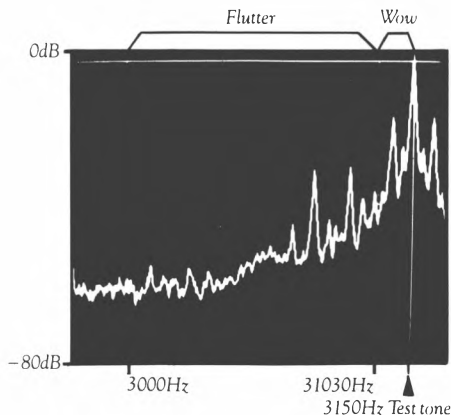


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



JVC KD-VR5

JVC (UK) LTD, 12 PRIESTLEY WAY, ELDONWALL TRADING ESTATE, STAPLES CORNER, LONDON NW2 7AF.
TEL: 01-450 3282



JVC's auto-reverse *KD-VR5* has a profusion of facilities, yet lacks some of the more useful functions one would expect to find on a deck of this price. Tape selection is manual, using a twin button, interactive combination system. Dolby B and C selection is similar, and fortunately both have a status confirmation display. The record level indicators are a bright fluorescent yellow and red with a broad range and reasonable resolution. Additionally, JVC add a numerical peak level readout, which looks good. The cassette lid houses an LED display for tape direction, play and record modes.

The logic transport is fast and smooth in action, if slightly noisy, and will happily accept most unusual commands, except 'punch-in' record. Recording level is set with a slider control that operated smoothly.

Styling variations include symbols for stop, fast forward, reverse, and record to legends for play, record and scan. Elsewhere, different facilities have different coloured legends. With so many to choose from — no matter how bright and clear — the fascia is decidedly overcrowded and often difficult to understand. Other facilities include memory or auto-stop, and repeat play, the former with a display, the latter without. Overall, the

KD-VR5 is packaged stylishly for lovers of buttons and lights, but at the expense of ease of use.

LAB REPORT

Auto-reverse decks have to be carefully engineered and adjusted if they are not to suffer severe azimuth error, which manifests itself as a dull sound with pre-recorded tapes, in one direction or another — and sometimes both. The *KD-VR5* sample was in extremely bad adjustment, measuring no less than -7dB down at 10kHz . This will make it sound extremely dull with pre-recorded tapes.

Providing replay is carried out in the same direction in which a recording was made, azimuth error does not affect the recording quality of a deck. That this is the case can be seen by comparing the extremely flat recording frequency responses with the replay-only response with pre-recorded tapes; the latter is very obviously non-flat.

The transport exhibited some speed drift and low rate wow, plus capstan wow, which is heard as a slight warbling effect.

SOUND QUALITY

We heard pitch vagueness introduced by drift and low rate wow, and could just detect a slight warble

on steady piano and oboe notes too, on both recordings and pre-recorded tapes. At the price this is not an especially notable performance, though arguably adequate for uncritical listening.

The head gave an overload (MOL) performance similar to the budget decks in this report. It wasn't especially bad compared to some, but it wasn't too good either. In listening tests, we suspected that the head was responsible for a somewhat compressed sound with metal tape and some muddling with chrome. Ferric was satisfactory. Recording quality was good, but not exceptional. Falling treble in the replay response made pre-recorded tapes sound awful. We wrote it off altogether for playing musicassettes, since the sound was so muffled and dull.

SUMMARY

Overall the VR5 is a looker rather than a performer. While a variety of facilities and displays are included, simple desirables like auto tape selection and 'punch-in' record are not. Performance was very disappointing with musicassettes, which were completely smothered. And with the exception of ferric, even recording had a tendency to compression and muddle. The bottom line is that the performance doesn't match the packaging.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 35Hz-5.0kHz very poor
 Speed accuracy _____ +0.9% average
 Noise _____ -58dB average

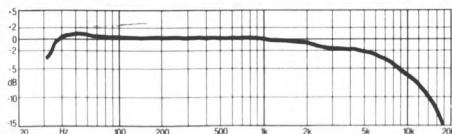
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-18.0kHz very good
 Frequency response, chrome _____ 27Hz-19.0kHz very good
 Frequency response, metal _____ 27Hz-20.0kHz very good
 Stereo separation _____ -45dB poor
 Distortion _____ 0.6% good
 Noise _____ -55dB very good
 Speed variation _____ 0.10% very good
 Modulation noise _____ -40dB good
 Flutter energy (band level) _____ -28dB good
 MOL, ferric, 315Hz/10kHz _____ +4.5dB/-7.0dB good
 MOL, chrome, 315Hz/10kHz _____ -1.0dB/-7.0dB poor
 MOL, metal, 315Hz/10kHz _____ +2.0dB/+1.0dB poor

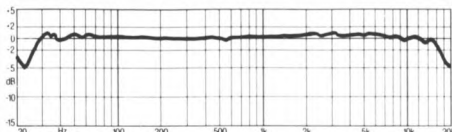
Input/output performance

Line in (sensitivity/overload) _____ .85mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 330mV
 Typical price inc VAT _____ £219

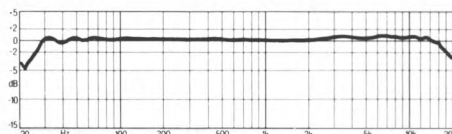
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



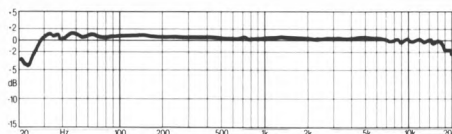
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

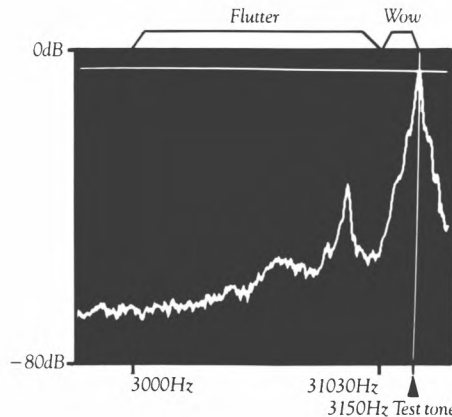


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



JVC DD-VR77

JVC (UK) LTD, 12 PRIESTLEY WAY, ELDONWALL TRADING ESTATE, STAPLES CORNER, LONDON NW2 7AF
TEL: 01-450 3282



In company with their other models in this price range JVC's auto-reverse VR77 has a plethora of facilities, lights and control buttons — so much so that the machine wouldn't look out of place on the flight deck of the Starship Enterprise. The logic transport control buttons run vertically alongside the cassette holder, with other functions and displays in a horizontal arrangement on the left of the deck. Transport operation was smooth and relatively silent, accepting a variety of commands with ease, including 'punch-in' record. Reverse mode has three operating options: single-side play, both-sides play, or continuous play; a separate button offers manual reverse.

Tape-type recognition is automatic — always a useful feature — backed by a fluorescent status display. Dolby B and C are selected by mutually dependant push buttons, again with their own warning display. The peak level meter, digital peak indicator, noise reduction systems display, tape type display and numerical counter all share the same fluorescent display panel. The peak level meter has good range, -20 to +9, with excellent resolution. Tape direction, pause and record have a separate LED display on the cassette lid.

Other facilities include 'Blank skip' which locates the gaps between each track, and 'scan' and 'scan set', which allow track skipping and the

programming of preselected tracks in either tape direction. An uncommon addition is a multi-editor which allows accurate editing during recording.

LAB REPORT

Although direct drive and auto-reverse, the DD-VR77 does not use a dual-capstan system, but nevertheless has exceptional speed stability in the forward direction, if not in reverse. The latter proved only comparable to budget standards, but this is often the case with auto-reverse decks; they work well in one direction, but not in the other. The spectrum analysis shows reverse performance, with drift, wow and flutter. Auto-reverse decks often suffer reverse azimuth errors too, but the VR-77 managed to avoid this problem. There was the usual fall off in high frequency output with pre-recorded tapes, measuring -3dB at 10kHz in both directions of play.

JVC consistently achieve low hiss and hum figures with their decks and the VR77 was no exception, noise being a few dB better than most other machines. However, JVC set their peak record level (0VU) lower than most so recording up to this point will result in good distortion, rather than low noise. Head overload figures (MOLs) were respectable, but it is obvious that bias has been set a bit high to get a low 300Hz distortion figure, at the expense of high

frequency overload (saturation). The deck has no tape tuning at all, but proved well set up for standard hi-fi tapes like TDK *AD*, Maxell *UD-II* and TDK *MA-X*.

SOUND QUALITY

With TDK *MAX* metal tape, treble sounded slightly thin and had a 'piercing' quality; sibilance 'spitch' was noticed. Maxell *MX* proved a better sounding match, exhibiting some 'warmth' and fine treble smoothness. Excellent piano pitch stability was noted recording onto BASF *CR-EII*. Notes sounded very solid and credible in the forward direction; reverse-recording resulted in 'watery'-sounding notes, due to wow. Ferric tape (TDK *AD-X*) displayed fine tonal balance, but with a lack of transient bite and a vague-sounding treble, caused by early saturation.

Regrettably, music cassette reproduction was very poor, tapes sounding muffled, thick and, frankly, turgid.

SUMMARY

The *DD-VR77* has arrays of buttons and impressive red and orange displays, making it look extremely complex. At heart, though, it is a simple auto-reverse of good but not exceptional performance. Recording quality was fine with all tape types, but music cassette replay quality was very disappointing.

TEST RESULTS

Replay of pre-recorded music cassettes

Frequency response _____ 40Hz-9.0kHz average
 Speed accuracy _____ +0.5% good
 Noise _____ -63dB very good

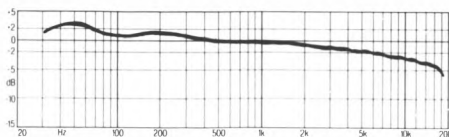
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-18.0kHz very good
 Frequency response, chrome _____ 27Hz-14.0kHz good
 Frequency response, metal _____ 27Hz-20.0kHz very good
 Stereo separation _____ -50dB average
 Distortion _____ -0.6% good
 Noise _____ -56dB very good
 Speed variation _____ 0.03% very good
 Modulation noise _____ -38dB average
 Flutter energy (band level) _____ -27dB good
 MOL, ferric, 315Hz/10kHz _____ +4.0dB/-9.0dB average
 MOL, chrome, 315Hz/10kHz _____ +0.0dB/-9.0dB average
 MOL, metal, 315Hz/10kHz _____ +4.2dB/-2.0dB very poor

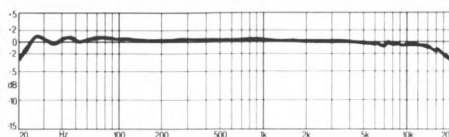
Input/output performance

Line in (sensitivity/overload) _____ 80mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 500mV
 Typical price inc VAT _____ £349

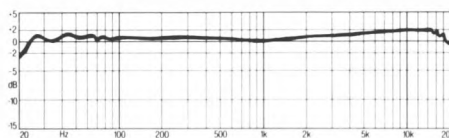
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



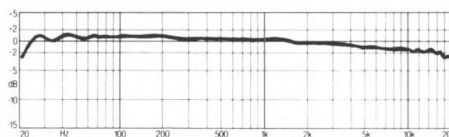
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

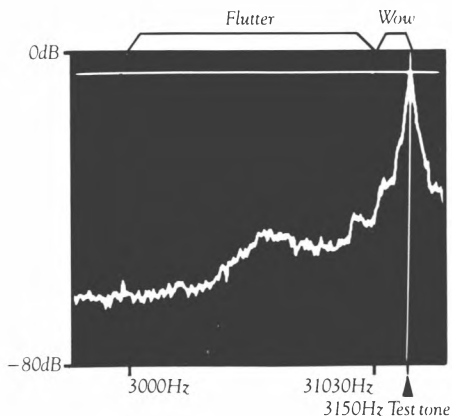


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS (reverse direction)



COMMENDED

MARANTZ SD151

MARANTZ AUDIO (UK) LTD, 15-16 SAXON WAY INDUSTRIAL ESTATE, MOOR LANE,
HARMONDSWORTH, MIDDX UB7 0LW. TEL: 01-897 6633



This budget deck is simply styled in the now mandatory black, with legends in gold. The mechanical transport responds fairly quickly but noisily to commands, the mechanical inter-linking allowing actions such as fast forward to fast reverse, but there is no 'punch-in' record and record mode is interlocked with play.

Tape selection is manual, using large panel buttons (which squeaked). It is possible to select two tape types simultaneously using this system of selection, but fortunately there is a green LED display that indicates the selection made. The peak level meter has an LED display having a range of -10 to +6. Resolution proved poor, as is sometimes the case with budget machines.

Noise reduction is Dolby B only on the 151 (the additional C system being found on the 152), and is operated by a large panel button with an LED display. Dolby B gives 10dB of noise reduction which is adequate to achieve very low hiss, if not quite enough to make hiss inaudible. Super low noise tapes such as TDK SA (new 1986 formulation) or BASF CR-E11 will be best choices for this deck. Record level is adjusted using a master rotary control, and headphone and mike sockets are also fitted, the latter becoming increasingly rare these days.

LAB REPORT

The speed stability analysis shows clearly a classic case of distributed low rate wow, and more drift than usual. There's not a lot of flutter, though, band energy level measuring a very respectable -30dB, whereas -20dB or poorer can be found elsewhere. Wow and flutter of 0.15% and 0.1% also reflect this performance.

Comparison with the Teac V-343 machine shows that the two are very similar in measured performance, and inspection of their response graphs suggests they may use common components internally. The identifying 'fingerprint' to look for in these graphs is the pattern of low frequency response ripples, which are a function of the head's physical contour. These are identical below 100Hz, so it is hardly surprising then that the head overload figures (MOLs) are also a problem for the 151.

As with so many budget decks, it is probably better to use ferric tape than metal, provided that some softness and diffuseness of treble quality can be tolerated. Regrettably, the SD-151 is adjusted to give a rising treble with standard ferric tapes like TDK AD, so only budget ferrics will sound acceptable in terms of tonal balance.

The frequency response with pre-recorded tapes again closely matches the Teac V-343, having slightly falling treble, around 2dB down

at 10kHz.

SOUND QUALITY

Metal tape (Maxell *MX*) was smooth and clean, except at high levels where a degree of muddle intruded. Transients were well defined and there was a strong sense of clarity. There was a slight warmth to the sound. Piano was a little unsteady on chrome tape (BASF *CR-EII*), displaying mild 'wateriness' of pitch, but it was not obviously offensive and withstood close listening. TDK *SA* sounded bright and sharp without losing body or transient definition. High level treble became soft, suffering some muddle and messiness in the overall sound which suggested overload distortion. TDK *AD* was far too bright, which is a pity, because otherwise it was fairly clean.

Loss of upper treble was apparent on music cassette, though there was reasonable insight and the strands of music were well separated, as far as current budget decks go. Bass lines were weak and there was no deep bass.

SUMMARY

Styling was clean and simple and Marantz have taken the trouble to include a worthwhile tape selection display. Performance was reasonable for a budget machine, though the *151* has been adjusted to give rising treble with standard ferric tape, which in turn means using cheap ferrics with poor performance. Musicassette performance was unexceptional.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 40Hz-11.0kHz good
 Speed accuracy _____ +0.6% good
 Noise _____ -60dB good

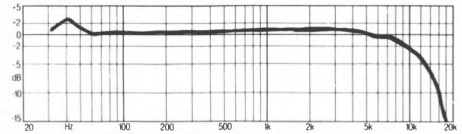
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-8.0kHz average
 Frequency response, chrome _____ 27Hz-14.0kHz good
 Frequency response, metal _____ 27Hz-16.0kHz very good
 Stereo separation _____ -49dB average
 Distortion _____ 1.5% average
 Noise _____ -54dB very good
 Speed variation _____ 0.15% very good
 Modulation noise _____ -40dB good
 Flutter energy (band level) _____ -30dB very good
 MOL, ferric, 315Hz/10kHz _____ +3.0dB/-5.0dB good
 MOL, chrome, 315Hz/10kHz _____ +1.0dB/-7.0dB poor
 MOL, metal, 315Hz/10kHz _____ +2.0dB/-0.5dB poor

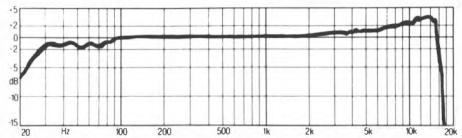
Input/output performance

Line in (sensitivity/overload) _____ 75mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 500mV
 Typical price inc VAT _____ £89

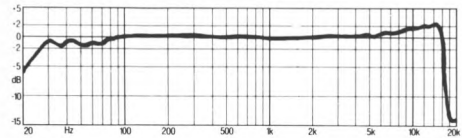
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



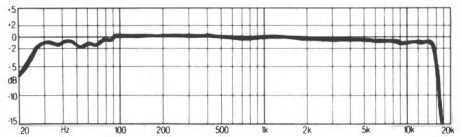
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

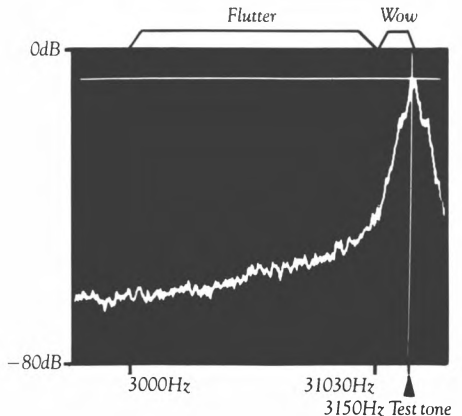


Type II (chrome or pseudochrome)



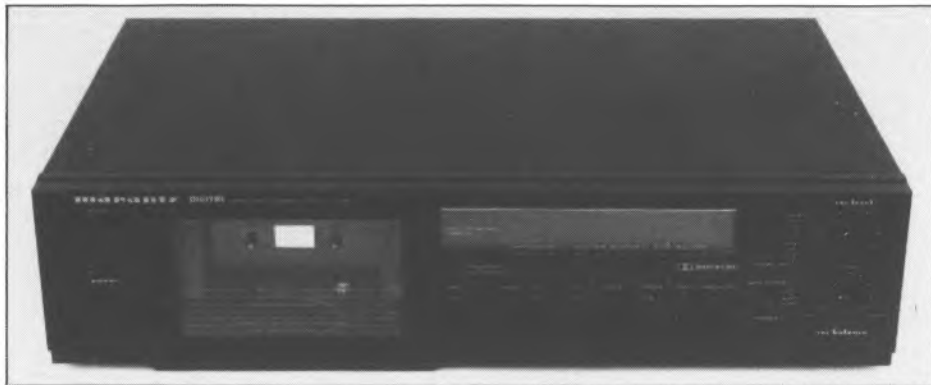
Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



MARANTZ SD-45

MARANTZ AUDIO (UK) LTD, 15-16 SAXON WAY INDUSTRIAL ESTATE, MOOR LANE,
HARMONDSWORTH, MIDDLESEX UB7 0LW. TEL: 01-897 6633



Despite notable success with amplifiers and CD players in particular, Marantz's cassette recorders have a less illustrious history. However, the *SD-45* shows signs of a serious attempt to change matters, following a simple enough formula where user convenience reigns, performance being obtained through high quality components and good set-up rather than technicalities such as user adjustable bias.

The fascia is quite uncluttered and smart, with lettering in old gold on a satin black background. A certain amount of hollow metallic clanking accompanies the transport solenoids, but logic control and light-touch operating panels combine to make operation comparatively easy. Legends and symbols together identify functions, and a bright blue fluorescent display panel clearly shows the status of the automatic tape type selection and Dolby noise reduction. A four-digit illuminated counter has memory function to stop rewind automatically at a pre-determined point.

LAB REPORT

The ferric and chrome recording response graphs show slight treble boost, which will combine with the natural slight lift in hi-fi tapes like TDK AD and SA to give mildly accentuated treble

and a bright sound. However, adjustment for metal tape is such as to cope with the treble lift of most modern metal formulations.

The head manages to get respectable levels onto all tapes including metals — an area where so many recorders fall down. This fact and the nature of the frequency responses suggests clean recordings are likely. Neither was there any sign of hum in the recording or replay amplifiers, and hiss levels were adequately low too, resulting in good dynamic range.

Speed stability tests revealed some slow speed drift, which may be seen as the smooth outline and fat base to the test tone 'spike' at right in the flutter analysis. However, this analysis also shows remarkably little flutter, so the *SD-45* still looks quite respectable overall — at least in measured terms. (Only listening tests can fully determine the subjective impact of these complex phenomena upon sound quality.)

I was pleased to see close adherence to the international IEC replay standard, confirmed by the flatness of the replay response graph. This ensures good clarity and tonal balance with pre-recorded tapes, and is a sure sign that a manufacturer is paying serious attention to performance.

SOUND QUALITY

Metal tape (TDK MA-X) suffered a strong treble

'sting', and had a 'coarse' quality which was not too nice. Otherwise, there was little sign of high level muddle, and recordings sounded clean. JVC ME metal tape gave a full and dense sound but lacked treble sting, as would Thats MG-X which we didn't try: rising-treble metals don't suit this deck. Chrome tape (TDK SA-X) was again bright and thin sounding, but was messy in treble character. It was clear in the midband but light in bass. Piano (Sony UX PRO) had vague pitch and occasionally sounded pitch indeterminate, though no obvious shake was evident. Ferric tape (TDK AD) sounded fiercely bright. BASF LH-EI and less expensive tapes proved a better match.

Musicassettes showed most plainly that the SD-45 has very weak bass and sounded thin. An otherwise light, detailed and precise sound, lacked 'punch' and dynamism.

SUMMARY

The SD-45 is a simple, conventional cassette deck, but one obviously designed to be easier than usual to use. Measured performance was respectable, indicating thoughtful design on a limited budget. Sound quality veered toward thinness on both recordings and pre-recorded tapes, which somewhat compromised the overall quality of reproduction.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 32Hz-20.0kHz very good
 Speed accuracy _____ +0.7% good
 Noise _____ -60dB good

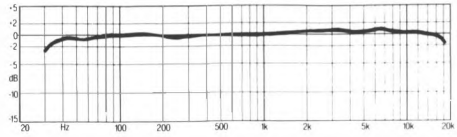
Record/replay using blank tape

Frequency response, ferric _____ 30Hz-14.0kHz good
 Frequency response, chrome _____ 25Hz-17.0kHz very good
 Frequency response, metal _____ 25Hz-16.0kHz very good
 Stereo separation _____ -48dB average
 Distortion _____ 1.7% poor
 Noise _____ -54dB very good
 Speed variation _____ 0.10% very good
 Modulation noise _____ -40dB good
 Flutter energy (band level) _____ -33dB very good
 MOL, ferric, 315Hz/10kHz _____ +3.5dB/-9.0dB average
 MOL, chrome, 315Hz/10kHz _____ +0.0dB/-8.5dB average
 MOL, metal, 315Hz/10kHz _____ +3.0dB/-1.0dB poor

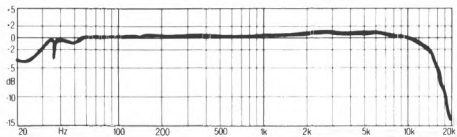
Input/output performance

Line in (sensitivity/overload) _____ 100mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 500mV
 Typical price inc VAT _____ £159

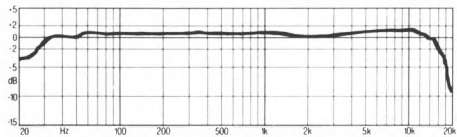
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



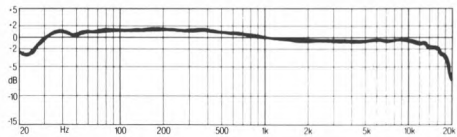
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

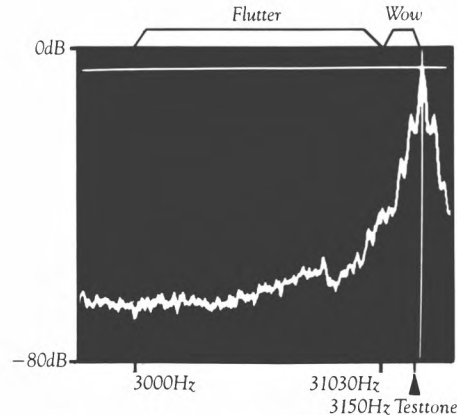


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



MARANTZ SD-74

MARANTZ AUDIO (UK) LTD, 15-16 SAXON WAY INDUSTRIAL ESTATE, MOOR LANE,
HARMONDSWORTH, MIDDLESEX UB7 0LW. TEL: 01-897 6633



This expensive, three-head auto-reverse machine is fitted with dbx in addition to Dolby B and C noise reduction systems. Marantz told me the word 'digital' on the fascia referred to their view that dbx made the SD-74 'digital ready' by giving it as much dynamic range as digital systems (such as Compact Disc), a view that I (and others) cannot share. In practice dbx introduces noise modulation which can produce a 'whooshing' around solo piano notes, for example. This degradation in my view outweighs the slightly better overall hiss level of Dolby C, but this is fitted in any case.

Independent record and replay heads in a rotating head platform means that twin independent, stationary erase heads must be used for reverse-recording, making this a four-head deck. Fast auto-reverse with optical leader tape sensing is used, and a selection of music search systems are fitted. Bright blue fluorescent displays are used for the record level meters and tape counter. The logic controlled transport worked nicely, although it is noisy when changing direction and a small stop button was difficult to find. The SD-74 did not really seem to offer that much in the way of facilities, considering its price.

LAB REPORT

The head end stops were out of adjustment in the reverse direction, introducing azimuth error and falling treble (-4dB at 12kHz) in the replay frequency response, and this was amplified as always by Dolby B. However, in the forward direction the replay response demonstrated that Marantz do attempt to follow IEC 94.

Hiss in the replay amps was low, but -59dB of hum was not — though it only became noticeable with low level recordings played at high volume. Low record amplifier noise and -18.5dB of Dolby C noise reduction kept hiss to a low -72.5dB with chrome tape. Peak record level (OVU) has been set to Dolby level.

The transport ran slow forwards (-0.3%) and fast backwards ($+0.7\%$), giving a speed difference of 1% which will be just noticeable at fast reverse. Speed stability characteristics varied, both over time and between forward and reverse. In reverse, jerky speed variations produced 0.3% flutter peaks and, over a period of many minutes, wow would occasionally rise to 0.2% . Although not by any means intolerable, it is not impressive considering the price.

Distortion was very high at low frequencies where it measured 4.5% , hence degrading the overall average figure. The head gave good

overload figures with ferric tape but was not better with metal. I suspect that it was saturated by the high bias needed for metal.

Frequency response with ferric and chrome tapes was flat, but metal had some bass emphasis. Sony ES metal tape gave good results, due to its increased treble sensitivity.

SOUND QUALITY

Initial recordings on TDK MA were bass heavy, but this cleared after a few auto-reverses, settling down to a slightly 'warm' tonal balance with acceptable treble attack. Wow was apparent even with non-critical rock music on vocals, piano and the like. It 'blurred' recordings and was generally heard as 'smearing', rather than discrete warbling. dbx gave 'sing-along' hiss, as usual, Dolby C being preferable. Chrome (TDK SA) gave a good, even tonal balance but the speed stability problems remained, introducing blurring. Distortion was heard on vocals, doubtless due to the very low MOL of the deck, adding 'messiness'. Ferric (TDK AD) gave the same warm sound as metal, but with 'fluffier' treble, as is usual. Both wow and flutter contaminated vocals.

Musicassettes gave well differentiated treble detail in the forward direction, but a woolly sound with muffled transients in reverse. Speed instability was apparent as obviously irregular warbling on sustained notes. 'Gritty' flutter components were heard too.

SUMMARY

The SD-74 is expensive, and has the ability, unusual in an auto-reverse deck, to provide off-tape monitoring. Yet in spite of the high price, some useful facilities have been omitted. The deck was found easy to use, except for its small stop button. Sound quality was mediocre-to-poor in most respects. Overall, we thought that this up-market Marantz model represented poor value for money.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 28Hz-10.0kHz good
 Speed accuracy _____ +0.7% good
 Noise _____ -60dB good

Record/replay using blank tape

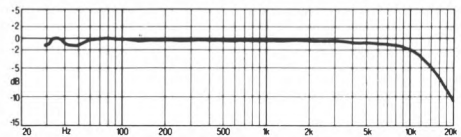
Frequency response, ferric _____ 20Hz-20.0kHz very good
 Frequency response, chrome _____ 20Hz-20.0kHz very good
 Frequency response, metal _____ 20Hz-20.0kHz very good
 Stereo separation _____ -48dB average
 Distortion _____ 3.1% very poor
 Noise _____ -54dB very good
 Speed variation _____ 0.14% average
 Modulation noise _____ -35dB very poor
 Flutter energy (band level) _____ -24dB average
 MOL, ferric, 315Hz/10kHz _____ +3.5dB/-5.0dB good
 MOL, chrome, 315Hz/10kHz _____ -1.0dB/-5.5dB poor
 MOL, metal, 315Hz/10kHz _____ +3.0dB/+0.0dB average

Input/output performance

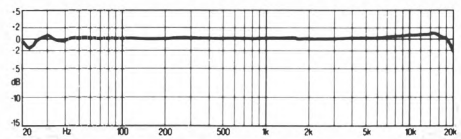
Line in (sensitivity/overload) _____ 85mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 500mV
 Typical price inc VAT _____ £350

REASSESSED

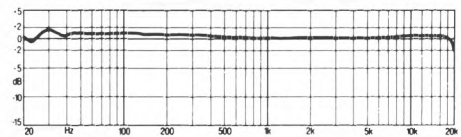
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



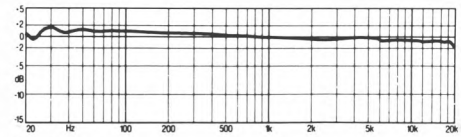
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

NAD 6220

NAD SALES, COUSTEAU HOUSE, GREYCAINE ROAD, WATFORD, HERTS WD2 4SB.

TEL: (0923) 26499



Simplicity of style is NAD's motto and the 6220 certainly lives up to it. Housed in a strong, smoke-grey box, this model is starkly simple, lacking the over-complicated descriptions and styling lines seen on other inexpensive models. Legends are consistent and minimal, giving the fascia a neat clean appearance. The mechanical transport buttons are arranged horizontally beneath the cassette lid, and are easy enough to operate, although they 'clank' noticeably. Unusual commands such as fast forward or reverse, from record mode are handled well.

Tape selection is manual, using a rotary switch. The metal tape option has been omitted presumably because NAD consider metal tape sales are too low to bother with this facility on a budget deck. The machine has Dolby B and C, selected by a rotary switch with associated LED display. A multiplex filter can be selected at the back of the deck by a sliding switch.

NAD fit a simple LED record-level meter of limited -10 to +6 range, and poor resolution, but this is not uncommon on budget decks. A dual concentric record level control is clumsy to operate when trying to adjust for balance, though convenient for fading.

LAB REPORT

Whereas the 6240 has a high 0VU level, the 6220 is set lower, at the most popular Dolby flux level. This level plus lack of provision for recording on to metal tape might suggest a head incapable of handling high flux levels. However, since the head gives identical performance to that of the 6240, both in its frequency response and overload (MOL) figures, it is clearly capable of recording equally high signal levels. Consequently, the MOL ceilings on both ferric and chrome were relatively high for a budget machine, although NAD achieve this result partly through a high bias which somewhat compromises treble overload. Tweaking up bias in this fashion also results in low distortion at low frequencies and in the midband; the 6220 measured just 0.5% THD at 40Hz and 0.4% at 300Hz, at 0VU, while the figure had risen to 1.8% at 3kHz.

Frequency response proved very flat with ferric and chrome tape, as the graphs show. Replay frequency response (which affects pre-recorded tapes only) displayed falling treble, measuring -3dB at 10kHz. Musicassettes will sound dull as a result.

The transport suffered serious speed drift, and in fact proved virtually incapable of running at

a set speed over a period of time with any degree of accuracy. There was wow and strong flutter too, both phenomena seen in the speed stability spectrum analysis. This is a poor result by any standards, and will affect both recording quality and musicassette replay quality, making notes sound unsteady and pitch-vague.

SOUND QUALITY

As the tests predicted, musicassette replay quality was poor on this deck. The sound was generally dull and slurred, with piano notes tending to merge into each other, for example.

With ferric tape (TDK AD) there was plenty of clarity and a wideband sound to recordings, but some coarseness and 'edginess'. 'Spitching' was heard with strong vocals, and musical timing was poor. Piano sounded very 'mushy' with BASF CR-EII. Changing to CR-MII for more treble improved clarity but also confirmed that most of the blurring and 'wateriness' of pitch was due to the transport's very poor speed stability.

SUMMARY

The 6220 only records on to ferric and chrome tape — not metal. It is very easy to understand and use but very poor speed stability substantially undermined sound quality, making pre-recorded tapes and recordings sound very hazy and poor in definition.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-7.0kHz poor
 Speed accuracy _____ +1.3% poor
 Noise _____ -62dB good

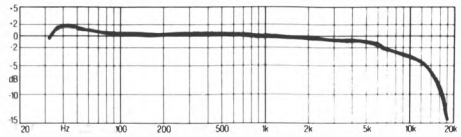
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-17.0kHz very good
 Frequency response, chrome _____ 27Hz-17.0kHz very good
 Frequency response, metal _____ N/A
 Stereo separation _____ -54dB good
 Distortion _____ -0.9% good
 Noise _____ -53dB good
 Speed variation _____ 0.15% very good
 Modulation noise _____ -37dB poor
 Flutter energy (band level) _____ -13dB very poor
 MOL, ferric, 315Hz/10kHz _____ +4.0dB/-10.0dB average
 MOL, chrome, 315Hz/10kHz _____ +1.0dB/-10.0dB average
 MOL, metal, 315Hz/10kHz _____ N/A

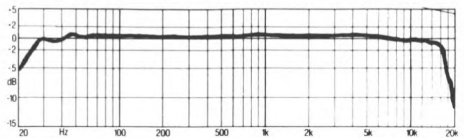
Input/output performance

Line in (sensitivity/overload) _____ 50mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 500mV
 Typical price inc VAT _____ £139

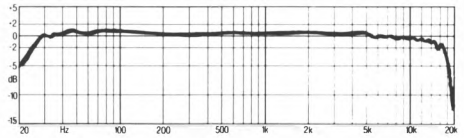
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)

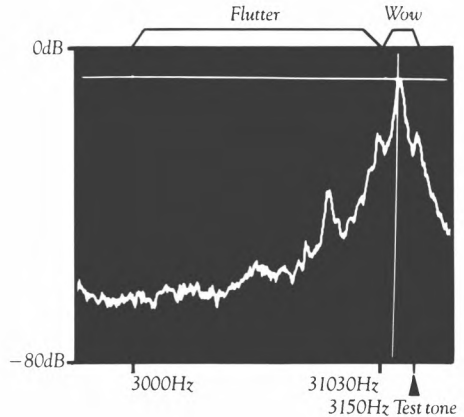


Type I (ferric or normal)



Type II (chrome or pseudochrome)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



NAD 6240

NAD SALES, COUSTEAU HOUSE, GREYCAINE ROAD, WATFORD, HERTS WD2 4JB.

TEL: (0923) 26499



The 6240 continues NAD's tradition of uncluttered simplicity. Legends are minimal, and above all bright and highly visible. The mechanical transport is smooth and relatively quiet in operation, but the buttons 'clank'. Tape selection does not have a status display, but the chunky rotary switch makes it almost foolproof. An MPX filter switch is located at the back of the machine, together with variable bias for fine tape tuning. Dual concentric control of record level proved a trifle fussy when balancing channels but convenient for fading.

The 6240 has both Dolby B and C, again selected from an easy-to-understand rotary control, backed by status LEDs. Perhaps the most useful extra control is 'Play Trim', which provides equalisation of musicassettes during playback.

LAB REPORT

The record/replay graphs clearly show that the 6240 has been very accurately aligned for standard hi-fi blank tapes, TDK AD, Maxell UD-II, etc. Better still, it has variable bias that works even with metal tape; the only anomaly is that the bias fine tune control is marked in terms of treble level, '+' meaning less bias and

'-' more bias! Nevertheless, the deck could be adjusted to match all blank tapes including the most unconventional.

Replay frequency response proved inaccurate for pre-recorded tapes, treble output being -6dB at 10kHz. Even 'Play Trim' couldn't correct this error, affecting output at 10kHz by only +/- 3dB. The 6240 will therefore sound dull with musicassettes.

There was little noise or hum in the replay amps, and replay speed proved correct too. Unfortunately, the transport mechanism tended to drift randomly and introduced low-rate wow also. The spectrum analysis reveals this in the width of the peak at right, and the result is that steady notes sound 'drunken' or uncertain in pitch. Flutter was acceptably low.

NAD use a good combination record/replay head which is capable of low distortion even at the 0VU flux adopted; head overload levels (MOLs) are consequently respectable. Because 0VU has been placed high, record levels onto metal tape shouldn't be pushed too far.

SOUND QUALITY

With treble -6db at 10kHz, pre-recorded tapes inevitably sounded very dull on this deck, and tuning 'Play Trim' right up to maximum could

not rectify the problem. Poor speed stability made all music 'hazy' in terms of pitch.

Ferric tape (TDK AD) exhibited 'softened' transients, due to treble saturation, but it had fulsome, deep bass. Sound quality was reasonable, though 'smeared' musical timing was obvious. A piano Nocturne on chrome tape (BASF, CR-III) displayed very 'watery-sounding' notes, due to the deck's speed instability, though there was not the obvious 'cracked' tone and pitch indeterminacy heard with some poor transports. Metal tape (TDK MA-X) gave a bright, light sound with fine clarity and good transient definition, but vagueness was again pervasive.

SUMMARY

Potentially a good deck through thoughtful design and sensible styling, our 6240 sample was let down by an inaccurate replay response that made musicassettes sound very dull, and by a transport that compromised note definition due to speed instability.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-5.0kHz very poor
 Speed accuracy _____ +0.2% very good
 Noise _____ -62dB good

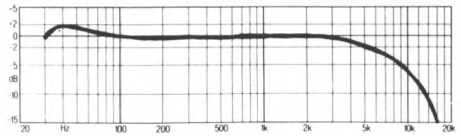
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-17.5kHz very good
 Frequency response, chrome _____ 27Hz-19.0kHz very good
 Frequency response, metal _____ 27Hz-20.0kHz very good
 Stereo separation _____ -53dB good
 Distortion _____ 1.5% average
 Noise _____ -55dB very good
 Speed variation _____ 0.15% very good
 Modulation noise _____ -40dB good
 Flutter energy (band level) _____ -24dB average
 MOL, ferric, 315Hz/10kHz _____ +3.6dB/-9.0dB average
 MOL, chrome, 315Hz/10kHz _____ +0.3dB/-10dB average
 MOL, metal, 315Hz/10kHz _____ +2.0dB/+0.0dB poor

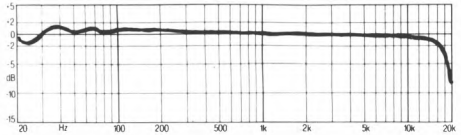
Input/output performance

Line in (sensitivity/overload) _____ 50mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 500mV
 Typical price inc VAT _____ £199

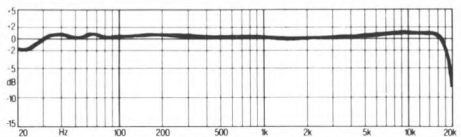
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



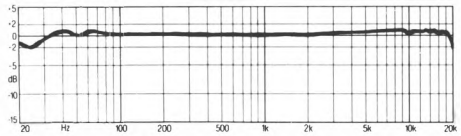
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

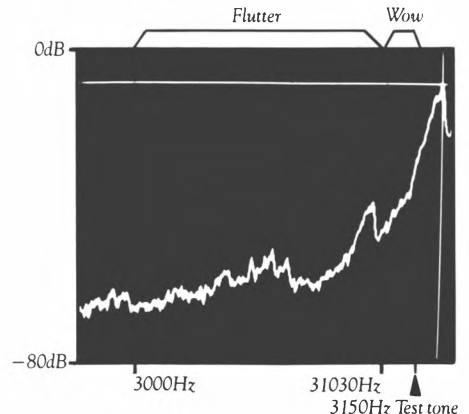


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



RECOMMENDED

NAD 6155

NAD SALES, COUSTEAU HOUSE, GREYCAINE ROAD, WATFORD WD2 4SB.

—TEL: (0923) 26499—



Styled to look chunky, the 6155 comes in NAD's usual rather sombre dark grey finish. Confusing styling artifices such as unnecessary legends and lines are absent, so the deck was easy to understand and use. Transport buttons actuate the cassette mechanism mechanically, so they lack logic and clang a bit. However, not much pressure is needed to operate the buttons, so the deck stood firm in use.

Innovation comes in the form of 'play trim' — a control that trims treble level to achieve flat replay frequency response, prior to Dolby deprocessing. This avoids the approximate doubling of replay errors that Dolby B introduces at low levels and is meant to combat the dull, lacklustre sound so frequently encountered with musicassettes.

Variable bias is also included, operating on all three tape types, including metal. It provides tape tuning, allowing a wide variety of blank tapes to be used. There is a switchable 19kHz pilot tone (MPX) filter. LED record level indicators cover a good range and have 0VU set to Dolby flux, as usual. They are placed after the treble boost of record-equalisation so show actual treble levels reaching tape. Finally, but importantly, Dolby HX Pro provides overload 'headroom extension'.

LAB REPORT

Azimuth was a bit out on my early test sample and treble output proved initially unpredictable, due to shaky head/cassette location. After use and azimuth re-alignment (it's not generally my policy to do this), the deck settled down, providing a reliably flat replay frequency response to 10kHz with zero play trim, according to the official IEC (BASF) test tape.

'Play trim' worked well, giving around 3dB lift and cut at 10kHz, not shown in the replay graph. This is meant to trim record-equalisation errors in musicassettes, which occur quite commonly, due to a lot of misunderstanding over standards. The other common problem of incorrect recorded azimuth is also combatted.

The record/replay graphs clearly show reasonably matching to IEC Primary Reference tapes at centre-bias, and (filter out) a broad, flat frequency response characteristic.

Output at very high frequencies was stable, contributing to a low modulation noise figure of -42dB in spite of using a single capstan transport. Analysis showed that this mechanism suffers little flutter, but distributed wow was higher than usual, as one might expect from a solidly built transport with a heavy flywheel and thick capstan, but this balance is acceptable. Subjectively, flutter can be as annoying as wow,

but in a different way.

Hiss and hum levels were low, although high hum harmonics were present. Dolby B and C tracked well. NAD have chosen to use Dolby HX Pro simply to improve treble overload margins. The 6155 shows some distinct traits here, ferric tape having high midrange but average treble overload ceilings, whilst chrome is the reverse; metal tape did well in both areas.

Bias adjustment was sufficient to accommodate all awkward high performance tapes like Maxell *XL-IS* ferric, BASF *CR-MII* super-chrome, TDK *MA* and Maxell *MX*, giving the 6155 excellent flexibility and the potential for very accurate tape matching. Low input sensitivity calls for a high record level setting, especially with metal tape.

SOUND QUALITY

At centre bias TDK *MA* sounds edgy and had occasional peak distortion. Loss of clarity and 'imprecision' (slow wow) were noted too. Treble improved at '+4' bias. Maxell *MX* tape and conservative record levels (+3dB above 0VU) successfully provided a smoother, more confident sound with improved clarity; quality was judged very good, but piano remained 'watery' in pitch.

BASF *CR-MII* super-chrome (max bias) gave a very stable, even and natural sound, with fine clarity. It proved enjoyable and impressive. Slight drone (hum harmonics) was audible at high volume. There was less muddle than usual with BASF *LH-MI* ferric tape (centre bias), but high level treble was thin and indistinct, due to saturation. Overall quality was very good for ferric tape.

With musicassettes, piano again had a watery, imprecise quality to it — not offensive, but a degradation all the same. Generally though, sound quality reached a high standard, with well defined transients, a fine sense of clarity and solid bass. Imaging was good too. Play trim proved a valuable asset, limited boost often being needed to add zest and a sense of openness.

SUMMARY

Solidly built, but fairly simple, the 6155 lacks many minor facilities but includes some valuable ones. Dolby HX Pro gives improved tape

overload performance, user adjustable bias allows good and versatile tape matching while 'play trim' can minimise the dullness often heard with musicassettes. Easy enough to use, the deck 'feels' less sophisticated than most at the price. Balancing this was a good measured performance and excellent sound quality from musicassettes and recordings, 'advanced' tapes being usable. Slight wow compromised critical programme.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 221Hz-16.0kHz very good
Speed accuracy _____ +1.5% poor
Noise _____ -58dB average

Record/replay using blank tape

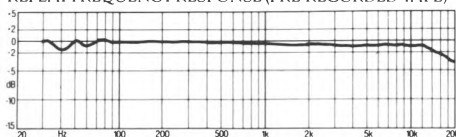
Frequency response, ferric _____ 221Hz-16.0kHz very good
Frequency response, chrome _____ 221Hz-17.0kHz very good
Frequency response, metal _____ 221Hz-18.0kHz very good
Stereo separation _____ -52dB good
Distortion _____ 1.3% average
Noise _____ -53dB good
Speed variations _____ 0.13% average
Modulation noise _____ -42dB good
Flutter energy (band level) _____ -34dB very good
MOL, ferric, 315Hz/10kHz _____ +4.5dB/-8.0dB good
MOL, chrome, 315Hz/10kHz _____ +0.5dB/-4.0dB average
MOL, metal, 315Hz/10kHz _____ +4.0dB/-2.5dB good

Input/output performance

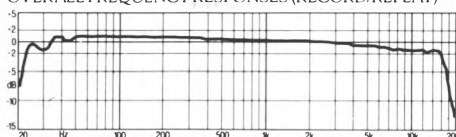
Line in sensitivity/overload _____ 130mV/>3V
Mic input sensitivity/overload _____ -mV/-mV
Output level _____ 650mV
Typical price inc VAT _____ £249

REASSESSED

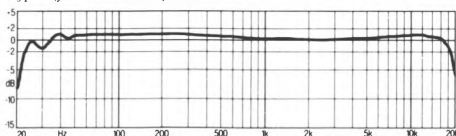
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



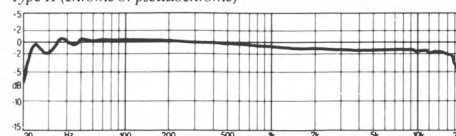
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

RECOMMENDED

NAKAMICHI BX100E AND BX125E

NAKAMICHI B&W (UK) LTD, MARLBOROUGH ROAD, CHURCHILL INDUSTRIAL ESTATE, LANCING,
WEST SUSSEX. TEL: (0903) 750750



For this 'budget'(!) machine Nakamichi do not fit Dolby C — the *BX-100E* had Dolby B only, which provides 10dB of hiss reduction, compared with Dolby C's 20dB. However, as tapes improve and get quieter this matters less. It is possible to make almost hiss-free recordings with Dolby B providing appropriately quiet tapes are used, together with high record levels. Dolby B is necessary for musicassettes as well.

Although Nakamichi's 'baby', the *BX100E* is still equipped with the same logic-linked, light-action transport control panels seen on their more expensive models. These require only a light tap with a finger to elicit an immediate response from the transport and the *BX100E* works with the same uncanny silence and silky precision as all Nakamichi's machines. The logic allows all commands except punch-in recording.

Selection of bias and equalisation are kept apart, allowing for example 120µS chrome tapes to be made. The bias buttons are, as always, con-

fusingly identified only by Nakamichi's own designations: EX (ferric), SX (chrome) and ZX (metal). Memory stop, timer and auto-repeat functions are fitted, but not microphone inputs.

Internally, independent bias and record-gain adjusters are fitted on left and right channels for each tape type, so the machine can be tweaked to suit any tape.

LAB REPORT

On test, the *BX-100E* had a replay response flat from 30Hz right up to 16kHz, after which output actually rises. The practical benefit is full treble output from pre-recorded musicassettes, coupled with proper Dolby B tracking, resulting in excellent clarity, detail and imaging.

Head alignment was correct and replay hiss adequately low. Spectral analysis revealed 50Hz and 150Hz hum components at -62dB, and subsequent listening tests showed these to be just audible when playing low level recordings at high volume. In my view hum should have

been lower. Replay speed was slightly fast at +0.8%, which is a just-detectable error. Replay speed stability was excellent at 0.05% wow and flutter (DIN weighted). Spectral analysis of a recording showed that the transport suffered various wow components from 3Hz to 8Hz in rate, but flutter was fairly low by single capstan standards. The transport was adequately speed stable.

Bias was well set to give a balanced low/high frequency tape overload performance and record-gain (sensitivity) was accurate enough with the IEC Primary Reference tapes to give correct Dolby tracking with recordings.

Frequency response (IEC Primary References) can be seen in the graphs; ferric and chrome are perfectly flat, metal has slight plateau emphasis of treble. This means metals with extra treble sensitivity, like TDK MA, will sound a bit bright. Distortion and separation figures were good; 0VU was set low (-3dB, ref Dolby level), if adhered to, making recordings a bit hissy.

SOUND QUALITY

Transients were delivered with real definition and bite from musicassettes, treble detailing was richer than one would generally imagine possible and imaging also proved better than usual. The presence of solid, deep bass added more 'body' than is common. A relatively clear, 'wideband' sound with musicassettes was both involving and entertaining.

We found recordings with TDK MA and Sony ES had a glassy-hard treble quality about them, due to the plateau lift of treble noted in tests, but freedom from flutter rubbish kept the treble clean. Hiss was barely audible with Sony ES recorded to a high level. Other IEC-like metal tapes, like Scotch XSM-IV and That's MG gave a more neutral sound. There was some sense of pitch-diffusion and occasional pitch 'falter' was detected with critical organ programme, but these phenomena were slight.

Chrome tape (TDK SA) gave a tonally smoother, less forward and more natural sound, but it also had less well differentiated treble. BASF CR-EII had similar properties, but was

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 23Hz-18.0kHz very good
 Speed accuracy _____ +0.8% good
 Noise _____ -61dB good

Record/replay using blank tape

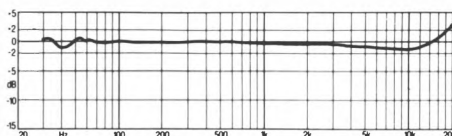
Frequency response, ferric _____ 20Hz-20.0kHz very good
 Frequency response, chrome _____ 20Hz-19.0kHz very good
 Frequency response, metal _____ 20Hz-20.0kHz very good
 Stereo separation _____ -57dB very good
 Distortion _____ 1.2% average
 Noise _____ -54dB very good
 Speed variations _____ 0.08% good
 Modulation noise _____ -42dB good
 Flutter energy (band level) _____ -36dB very good
 MOL, ferric, 315Hz/10kHz _____ +3.0dB/-6.0dB good
 MOL, chrome, 315Hz/10kHz _____ +1.0dB/-8.0dB good
 MOL, metal, 315Hz/10kHz _____ +4.0dB/-1.0dB poor

Input/output performance

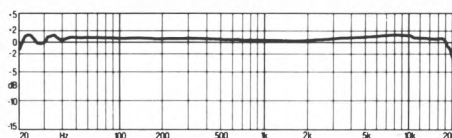
Line in sensitivity/overload _____ 52mV/>3V
 Mic input sensitivity/overload _____ -mV/-mV
 Output level _____ 450mV
 Typical price inc VAT _____ £315, £375

REASSESSED

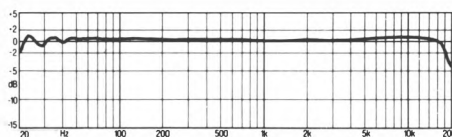
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



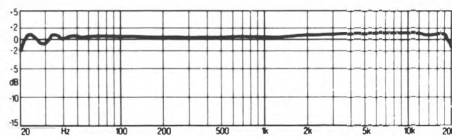
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)



marginally more lucid and 'solid' (pitch-stable) in its sound. The low 0VU level, when adhered to, made SA a bit hissy. Not bad, but not great, we felt.

Ferric recordings (TDK AD), like chrome, displayed even tonal balance but messier treble and more obvious hiss. Generally, though, their standard was judged to be good.

SUMMARY: BX100E

A high-performance and relatively expensive cassette deck, the BX100E lacks all but the most important facilities — even Dolby C is omitted. However, this deck is not a disappointment relative to its price, for those who rate sound quality highly and have enough knowledge to get the best from the machine, keeping in mind the comprehensive internal adjustment possible.

Additionally, Nakamichi's quality of build and finish, together with their slick and silent logic controlled transport system made the BX-100E satisfying to use, but independent bias and equalisation switching does require diligence to avoid error. Despite the lack of Dolby C, hiss wasn't a nuisance providing high quality 'quiet' blank tapes were used — such as Sony ES metal and BASF CR-EII — plus healthy recording levels.

SUMMARY: BX125E

The '125 is basically a BX-100 fitted with Dolby

C. This makes it similar to the BX-150, which was previously the least expensive Nakamichi to have Dolby C in addition to B. Visually, the '125 lacks the '150s illuminated red LED tape counter, and the output control is rotary instead of being a slider. Otherwise facilities are identical.

Under test the '125 proved very similar to the '100 and '150 in all respects; all test results printed are for the '100. It had good speed stability, characterised by very low flutter for a single capstan transport, but a small amount of wow (0.08%) at 2Hz and 5Hz.

I was disappointed to see rising treble with the IEC IV Primary Reference (metal) tape. Predictably, TDK MA measured +4dB up at 20kHz since it has more treble than the IEC tape. It will sound very bright as a result.

With BASF CR-EII chrome the '125 gave a silky-smooth and clear sound, but was restrained, or 'laid back'. There was more detail with SA, but it lacked CR-EII's confident treble and sense of natural clarity.

TDK AD ferric had a slightly warm tonal balance but good clarity for ferric and was liked. The sense of solidity achieved with musicassettes played on Nakamichi's dual capstan drives was not present with the '125, but it did have much of their clarity and insight, plus fine imaging. Another impressive performer, the BX125 is a 'Best Buy' while the '100E is still recommended.



The 'best buy' in this publication having narrowed down your choice in this excellent guide, you now need the help of a good dealer to select the product most suited to your system & listening preference. Acoustic Arts carry many of the Recommendations and Best Buys from this publication which are on permanent demonstration.

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RECOMMENDED

NAKAMICHI BX-300E

NAKAMICHI B&W (UK) LTD, MARLBOROUGH ROAD, CHURCHILL INDUSTRIAL ESTATE, LANCING,
WEST SUSSEX. TEL: (0903) 750750



Listening tests and lab tests consistently show that speed stability is a major problem on cassette decks, responsible for distortion, pitch slurring, diffuseness and many other obscure subjective phenomena. Closed-loop, dual capstan decks eliminate virtually all these degradations in one go and also isolate cassette tape from cassette mechanics, which can themselves produce severe flutter. Nakamichi use this drive system on all their more expensive decks, starting with the BX-300E.

Three heads have also been fitted, to allow off-tape monitoring, and user-adjustable bias for tape tuning. Nakamichi fit a single control for all tape types, so settings will have to be memorised when changing between types.

LAB REPORT

As expected speed stability was unusually good. Flutter measured 0.07%, wow 0.04% and there was virtually no drift. Flutter sideband analysis showed there were none! Some wow was measurable, but it was minor. The deck gave an amazing performance in this area.

Bias adjustment finely trimmed metal frequency response by a few dB at 20kHz, but this is all that is needed, because metal cassette tapes are much alike.

Chrome adjustment range was much larger, chrome and ferric tapes being more sensitive to bias change than metal. It was just sufficient, at maximum, to give perfect results with BASF *Chrom IIS* (superchrome) and therefore TDK SA-X as well. The deck can therefore be matched to the best 'chrome' tapes available.

As usual with current Nakamichi decks, replay frequency response had a -1dB or so dip at 2kHz, but treble rose steadily above this frequency to +2.2dB at 18kHz. However, by normal standards replay response was very flat and extended — something that is plainly audible we find. Replay speed accuracy was perfect at the pitch control's central setting, and adjustment range was a large 7%.

SOUND QUALITY

Metal tape (TDK MA) gave very neutral tonal balance, tinged by a slight extreme-treble lift. Increasing bias brought this under control and

sound quality was considered excellent. There was solid imaging, good, clean treble and delightful clarity. Reducing bias resulted in treble splash and was nasty. Some low rate speed instability was still just detectable, but we were being extremely critical here and expecting Compact Disc stability from our recordings — something the *BX-300E* nearly achieved.

Chrome tape (TDK *SA*) needed some bias increase to keep treble under control, but it was then difficult to be certain which was source and which was tape at times. These were astonishing results.

With ferric tape we found that there was a compromise to be made between best treble control (increased bias) and best treble level (decreased bias), using TDK *AD*. In the end, some 'softness' was accepted in return for good control. Other tapes would alter these observations though.

The *BX-300* replay quality with pre-recorded cassettes achieved much of the image stability and cleanliness that encourages close listening.

SUMMARY

The *BX-300E* was a pleasure to listen to, both with recordings made on the machine and with pre-recorded musicassettes, and remains one of the few really excellent machines we tested.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 50Hz-17.0kHz good
 Speed accuracy _____ +0.1% very good
 Noise _____ -61dB good

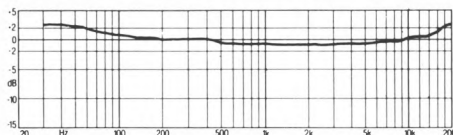
Record/replay using blank tape

Frequency response, ferric _____ 20Hz-20.0kHz very good
 Frequency response, chrome _____ 20Hz-20.0kHz very good
 Frequency response, metal _____ 20Hz-20.0kHz very good
 Stereo separation _____ -5.3dB good
 Distortion _____ 0.5% good
 Noise _____ -66dB average
 Speed variation _____ 0.04% very good
 Modulation noise _____ -41dB good
 Flutter energy (band level) _____ -36dB very good
 MOL, ferric, 315Hz/10kHz _____ +4.9dB/-7.0dB good
 MOL, chrome, 315Hz/10kHz _____ +3.0dB/-8.2dB good
 MOL, metal, 315Hz/10kHz _____ +6.6dB/-2.8dB poor

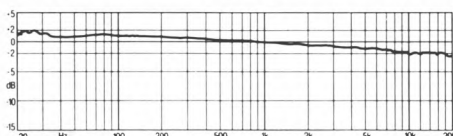
Input/output performance

Line in (sensitivity/overload) _____ 65mV/>-V
 Mic input (sensitivity/overload) _____ None
 Output _____ 930mV
 Typical price inc VAT _____ £595
 REASSESSED

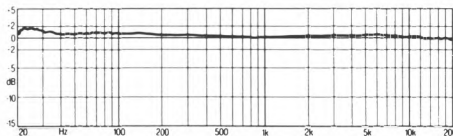
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



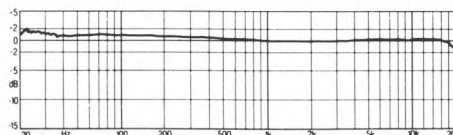
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



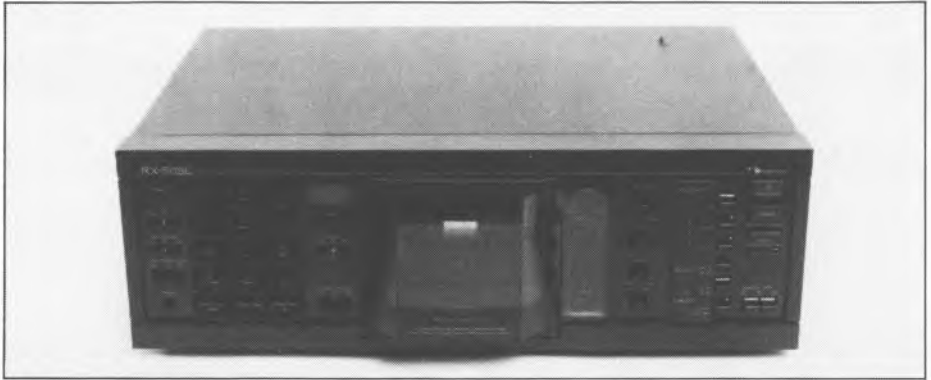
Type II (chrome or pseudochrome)



Type IV (metal)

NAKAMICHI RX505E

NAKAMICHI B&W(UK) LTD, MARLBOROUGH ROAD, CHURCHILL INDUSTRIAL ESTATE, LANCING,
WEST SUSSEX. TEL: (0903) 750750



Nakamichi's auto-reverse decks, the RX-202, '303 and '505, achieved instant fame as the whackiest gadgets ever to hit the hi-fi market. Their reversing system physically turns the cassette around, instead of making the transport go into reverse as do all others. All the head components remain securely located, so are not subject to the wear that will ultimately affect the rotating head platforms of normal auto-reverse decks, causing loss of treble due to incorrect azimuth. Tape-run azimuth error due to tape being pulled 'backward' in normal auto-reverse decks is avoided too.

The transport itself is a conventional dual-capstan design, not requiring the complexity seen in the *Dragon* and offering reverse recording besides. The RX505E does not have fast auto-reverse though; it records and plays through the leader, introducing a silence of around 12 seconds. Independent discrete record and replay heads give off-tape monitoring.

Nakamichi fit far more facilities to this deck than others, even the *Dragon* and ZX-9. It has music search (gap sensing), auto skip over a silent end in a musicassette, timer, fader, memory stop/play, MPX and subsonic filters. Unusually for a Nakamichi, 'punch-in' recording is possible with the logic controlled transport.

Bias fine tuning allows metal, ferric and chrome tapes to be matched accurately. Like all Nakamichis the RX-505E operates with silky precision, but independent bias and EQ selectors without status indicators give wide latitude for selection error. There are no mike inputs either.

LAB REPORT

As expected, frequency response of recordings can be adjusted to perfect flatness from 20Hz to 20kHz (using bias fine tune). The subsonic filter attenuates a response rise below 20Hz caused by equalisation circuits. The record-EQ settings were a bit curious, giving falling treble with IEC I and II Primary References (ferric and chrome) at centre-bias. Ordinary hi-fi tapes will sound dull at this setting, but the deck matches high performance tapes well.

Frequency response was flat with the IEC IV Primary References (metal), which means the deck suits most metals when using centre-bias. However, I was surprised to find there was insufficient bias range to obtain flat response from TDK MA, giving +1dB shelf lift which will add slight brightness. Bias reduction accommodated Maxell MX perfectly.

Nakamichi's discrete record heads have excellent performance, providing extremely high overload ceilings in the midband and at high frequencies

— without the use of Dolby HX Pro! In conjunction with low hiss, they give wide dynamic range. Hum was better suppressed than that of other models. Replay frequency response was close to flat from 20Hz right up to 20kHz.

When delivered, the deck had some wow (0.08%), but little flutter. A second sample had an identical spectral pattern and slightly worse performance figures, so the RX505E suffers slight wow and a bit more flutter (worse than a BX100E) than other Nakamichis.

SOUND QUALITY

Expecting perfection, Sony ES metal was a bit disappointing. The sound was either a bit bright with jittery treble, or dull, when adjusting bias. Maxell MX — surprisingly with bias increase — did sound near-perfect, with clean stable treble, a fine sense of clarity and a nice, relaxed delivery. Piano sounded 'watery' instead of solid in pitch terms. Matters were never quite right with BASF CR-MII, but TDK SA proved a perfect match, giving a clarity and stable treble which was unusual. Exceeding all expectations, ferric tape (TDK AD) gave most impressive results, relatively speaking, improving clarity and treble performance.

Musicassette reproduction had fine transients and stable imaging, too. Enhanced depth and some dimensionality were noted, resulting in a generally more plausible and lifelike quality to musicassette than is common, but some of the pitch solidity expected from a dual capstan transport did not materialise.

SUMMARY

The RX-505E is an auto-reverse deck with a unique and highly entertaining mechanical reverse system that physically spins the cassette around. The system also allows a complex dual capstan transport to be used, plus independent discrete record and replay heads that give the machine superb frequency response and overload headroom. Nakamichi's auto-reverse cannot be described as fast, but many other facilities, such as music search, blank skip and fine bias tuning are provided.

The transport operates with silky precision but does not have an excellent measured performance. There is broad tape matching, thanks to variable bias. Recording sound quality

reached a high standard with suitable tapes as did musicassette replay quality, but 'watery' pitch was a notable weakness.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 20Hz-20.0kHz very good
 Speed accuracy _____ +0.7% good
 Noise _____ -60dB good

Record/replay using blank tape

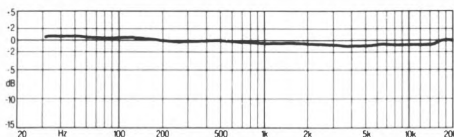
Frequency response, ferric _____ 20Hz-18.0kHz very good
 Frequency response, chrome _____ 20Hz-18.0kHz very good
 Frequency response, metal _____ 20Hz-20.0kHz very good
 Stereo separation _____ -49dB average
 Distortion _____ 0.3% very good
 Noise _____ -54dB good
 Speed variation _____ 0.1% average
 Modulation noise _____ -44dB very good
 Flutter energy (band level) _____ -32dB very good
 MOL, ferric, 315Hz/10kHz _____ +5.0dB/-3.0dB very good
 MOL, chrome, 315Hz/10kHz _____ +2.5dB/-7.0dB good
 MOL, metal, 315Hz/10kHz _____ +7.0dB/-0.5dB poor

Input/output performance

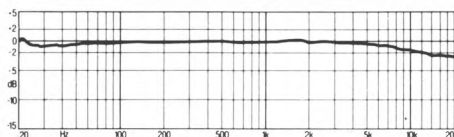
Line in (sensitivity/overload) _____ 50mV/>3V
 Mic input (sensitivity/overload) _____ -mV/-mV
 Output _____ 1000mV
 Typical price inc VAT _____ £895

REASSESSED

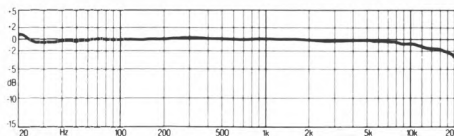
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



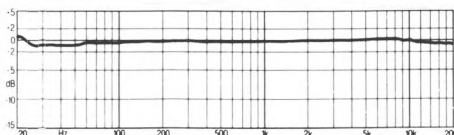
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

RECOMMENDED

NAKAMICHI CR-7

NAKAMICHI B&W (UK) LTD, MARLBOROUGH ROAD, CHURCHILL INDUSTRIAL ESTATE, LANCING,
WEST SUSSEX. TEL: (0903) 750750



As one of the world's most renowned manufacturers of high performance cassette decks, Nakamichi can rely on a flurry of excitement when they introduce a new top model. They have to their credit some innovations of astonishing complexity, so one never quite knows what mysteries are about to be revealed by the launch of a new product.

The CR-7, it transpires, is evolutionary rather than revolutionary. Most importantly, it retains the *Dragon's* motor-driven replay head that tilts left or right in order to align itself to any recording. However, it discards the *Dragon's* automatic sensing system, relying on the listener's ears instead. In other words, azimuth is user-adjustable. This might seem inferior to the *Dragon*, but in practice I find it preferable, even though the CR-7 is not a *Dragon* replacement or update.

The mechanism takes electrical commands from a front panel adjustment control knob or from 'left' and 'right' buttons on a remote control unit. Yes, this is a remote control cassette

deck too. As the head approaches correct alignment there is an audible increase in treble content. This adds clarity and makes percussion, such as cymbals and triangles, sound bright, natural and well defined. Further fine adjustment then focuses stereo images and positions the stereo sound stage. The final result with a good recording is a sense of focus in stereo imaging that is rarely heard from pre-recorded cassettes, plus significantly enhanced treble quality.

Recordings made on the CR-7 do not require azimuth adjustment. In fact when the deck is put into record mode, the replay head receives an internal command to return to its central position. If it didn't do this, sound quality monitored from the independent replay head would be deceptively dull, even though the recordings were perfect. This azimuth adjustment system applies only to recordings made on other decks, and in particular to commercially pre-recorded tapes (music cassettes).

Tape duplicating plants and engineers will love the CR-7 for its ability to show azimuth

errors so graphically. And it is this ability to display error and allow aural assessment of misalignment that makes the CR-7's manual adjustment system preferable, in my opinion, to the *Dragon's* completely automatic system.

For the first time a Nakamichi incorporates automatic tape tuning. The simple, fast, high resolution technique trims frequency response to within 0.3dB limits (at 15kHz ref. 400Hz) by altering bias, and then sets sensitivity. This is not an ideal way of going about things, but what it concedes in performance is more than made up for by the inherent quality of the deck's high performance independent record and replay heads (almost all other manufacturers use siamesed twin-heads, which have drawbacks).

Under test, Nakamichi's tuning system consistently achieved the quoted 15kHz value of 0.3dB and had enough range to cope with awkward tapes like BASF CR-MII. However, due to the high test frequency of 15kHz used, a few tapes with peaky treble, like BASF CR-MII and Sony ES, don't tune flat and sound a bit warm and bass heavy. Otherwise, the system provides an almost ruler flat frequency response from 20Hz right up to 20kHz.

Like all expensive Nakamichi decks, the CR-7 has a dual capstan transport mechanism. The main capstan is directly driven from a smooth-running motor which, Nakamichi claim, exhibits no cogging action or vibration. Tests of speed stability, using spectrum analysis, confirm this. The second capstan is belt driven off the main capstan and runs 0.2% slower, to provide constant back-tension. This largely eliminates jerking and uneven running, reducing flutter (high rate speed instability) in particular.

Two capstans can end up producing twice as much wow (low rate speed instability), unless the system is dimensioned so that drive line resonances don't correspond in frequency. This Nakamichi do, calling it a 'diffused resonance' transport. Again, high resolution spectrum analysis confirms that what little wow remains is distributed and not discrete. The overall wow and flutter figure I obtained was a quasi-peak reading of 0.04%, which is very low. Nakamichi claim 0.027%, which proved accurate when a long term average wow was computed from

Continued over page

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response	25Hz-18.0kHz
Speed accuracy	+0.7%
Noise	-63dB

Record/replay using blank tape

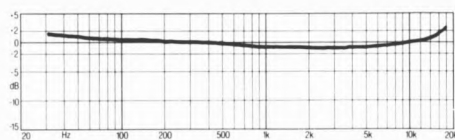
Frequency response, ferric	20Hz-20.0kHz
Frequency response, chrome	20Hz-20.0kHz
Frequency response, metal	20Hz-20.0kHz
Stereo separation	-53dB
Distortion	0.25%
Noise	-54dB
Speed variation	0.04%
Modulation noise	-45dB
Flutter energy (band level)	-33dB
MOL, ferric, 315Hz/10kHz	+4.8dB/-4.5dB
MOL, chrome, 315Hz/10kHz	+2.0dB/-6.5dB
MOL, metal, 315Hz/10kHz	+6.8dB/-1.0dB

Input/output performance

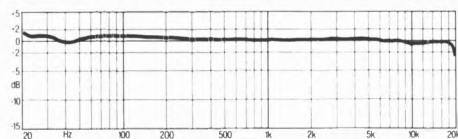
Line in (sensitivity/overload)	43mV/>3V
Mic input (sensitivity/overload)	None
Output	variable, 1000mV max.
Typical price inc VAT	£1,350

REASSESSED

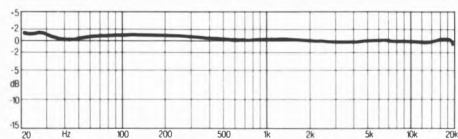
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



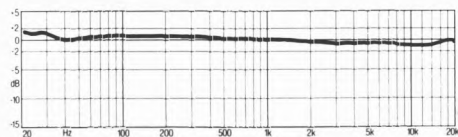
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

NAKAMICHI CR7

Continued from previous page



spectrum analysis.

At last, Nakamichi have adopted automatic tape type selection on one of their decks, together with manual over-ride for those who have their own ideas about what equalisation to use. The tape counter, part of the bright yellow fluorescent display panel, provides either a four-digit count or playing time remaining and playing time elapsed.

SOUND QUALITY

Perversely, perhaps, I got most excited about the CR-7's sound quality with musicassettes. New internal electronic circuitry, I suspect, gives a better balanced sound than the *Dragon*. There was stronger low frequency content, a better feeling of tonal neutrality, and less 'thinness' in the treble. All the *Dragon's* qualities of excellent imaging and a high degree of insight are retained though.

With Maxell MX recordings were so like the original that for all intents and purposes they were identical. Tests showed that the CR-7 gets massive levels on to metal tape before overload occurs. Using BASF CR-MII, there was some slight bass emphasis and warmth due to the

tuning error, but otherwise an extremely clear, smooth sound with a trace of treble 'softening' at high levels. TDK SA and Maxell UD-II both sounded very balanced, but with an almost subliminal sense of unease at high frequencies due to their relatively unsteady output compared with BASF chromes and Maxell MX.

As is often the case with very good decks, the CR-7 made ordinary, good ferric tapes like TDK AD sound as good as metals can on a lesser machine. The independent record and replay heads have much to do with this, since they raise the overload ceilings of ferric tape substantially.

SUMMARY

Making the CR-7 easy to operate and providing remote control has made Nakamichi know-how more palatable to the man in the street, providing he has a very deep pocket and an equally deep love of cassettes. This deck is far less of a high-technology wrestling match than a *Dragon* or ZX-9, but it improves on their sound quality and still has the sort of innovatory ideas that make a Nakamichi cassette deck a product with a legend in front of it.

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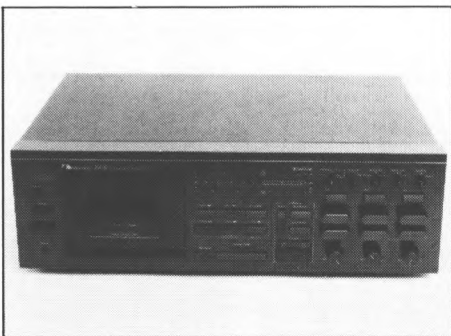
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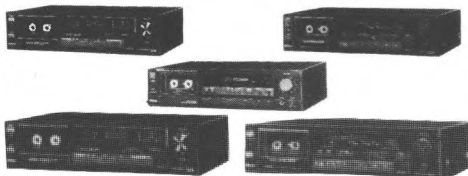


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This awesome-looking machine is totally fascinating in the way it seeks to overcome problems in cassette replay. The point to note with the *Dragon* is that its complexity is directed towards playing commercial musicassettes, or for that matter blank tapes recorded on other decks, with negligible transcription error. It also makes fine recordings — almost as a by-product!

Nakamichi's major innovation is the elimination of replay azimuth error, using an azimuth-sensing head which tilts automatically to give the optimum head-to-tape alignment for playback of any given recording. Sensing is achieved by splitting a single head pole into two stacked portions, comparing the phase of their output and then motor-driving an azimuth correction platform until phase error is zero.

As if auto-azimuth was not enough, the *Dragon* uses a dual-capstan, auto-reverse transport too. To accomplish this trick both capstans must change speed as well as direction, in order to apply tension, so independent capstan motors are necessary. Nakamichi use direct-drive to each capstan, which allows electronic speed trimming so the supply capstan always runs 0.2% slower. A quartz speed reference is used. As the *Dragon* design seeks to minimise azimuth problems, it uses a four pole

fixed-stack record head and cannot reverse record — only reverse play.

Manually variable bias and record gain are provided for each channel and tape type — seen as little adjusters on the fascia. Frequency response is set by bias adjustment, not by record equalisation. Bias selection and replay equalisation (120/70 μ S) are independently selectable, as usual on Nakamichis. The transport logic allows punch-in recording, whereas most Nakamichis do not!

LAB REPORT

I made a special short test tape to check auto reverse and auto-azimuth on the *Dragon*. Along the tape, azimuth increased in steps up to extreme error. Contrary to what the flashing indicators suggest, the deck applies continuous correction along the length of a tape — not just at the start — and it is achieved within about one second (the owner's manual and *Dragon* pamphlets do explain this). When the adjustment limit is reached, a fast clicking sound is heard, probably from a drive clutch. One commercial tape I played caused this noise, which was disconcerting, though the handbook makes no mention of it.

The test tape used wideband pseudo-random noise. Real-time spectral analysis showed the *Dragon* got replay response absolutely correct

within fractions of a second when azimuth changed! The system has astonishing resolution and accuracy, considering deviational errors are in terms of minutes of arc.

Replay frequency response followed Nakamichi's usual theoretical interpretation of the IEC standard, having a -1dB dip around 4kHz and treble lift above 12kHz (+3dB at 18kHz). Listening tests show this has no bad effect. The characteristic was identical in both directions of play. Replay speed was stable and had a negligible error of +0.4% fast, again in both directions of play. Replay speed stability was excellent at 0.03% total wow and flutter.

Cumulative record-plus-replay speed stability was much the same. I carefully checked the transport when playing a forward recording in reverse and found, as Nakamichi claim, that the transport gives nearly identical results to forward play.

Both wow and flutter were minimal. Spectral analysis showed that capstan wow really has been suppressed to a very low level on the *Dragon*. Analysis showed extremely low band-flutter and modulation noise too — amongst the lowest of any machine tested.

Replay hum wasn't low at -58dB, but since this was the 50Hz component only, more audible upper harmonics (100Hz and 150Hz) being around -65dB, it wasn't noticed in listening tests. Replay hiss was well suppressed. Record/bias noise levels were low enough to get full benefit from quiet tapes, but 0VU has been set low, so if used to set recording levels results in about -71dB hiss with chrome and Dolby C.

Tape distortions hardly exist. Below about 1kHz, switching from source to tape brought no change in the real-time display of spectral content and the read-out, even with an input signal of 40Hz at 0VU. At 3kHz though, total harmonic distortion had risen to 0.7% — and there's a reason behind this. Record equalisation has been set with bias high, to provide flat frequency response. High bias gives low bass/midrange distortion, but degrades treble distortion and overload (saturation). Treble overload (saturation) with metal tape (IEC IV) was relatively poor at -3dB, although it was respectable with ferric and chrome.

Bias adjustment range was enormous, even

Continued over the page

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 20Hz-18.0kHz very good
 Speed accuracy _____ +0.4% very good
 Noise _____ -61dB good

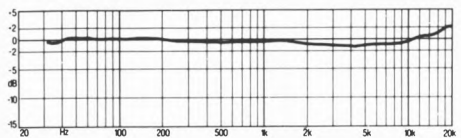
Record/replay using blank tape

Frequency response, ferric _____ 20Hz-20.0kHz very good
 Frequency response, chrome _____ 20Hz-20.0kHz very good
 Frequency response, metal _____ 20Hz-20.0kHz very good
 Stereo separation _____ -49dB average
 Distortion _____ 0.4% very good
 Noise _____ -54dB very good
 Speed variation _____ 0.03% very good
 Modulation noise _____ -45dB very good
 Flutter energy (band level) _____ -37dB very good
 MOL, ferric, 315Hz/10kHz _____ +4.0dB/-5.0dB very good
 MOL, chrome, 315Hz/10kHz _____ +1.2dB/-8.0dB good
 MOL, metal, 315Hz/10kHz _____ +6.2dB/-3.0dB very poor

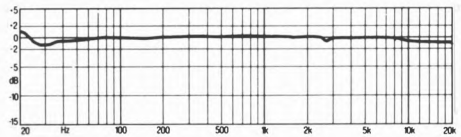
Input/output performance

Line in (sensitivity/overload) _____ 50mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 450mV
 Typical price inc VAT _____ £1500
 REASSESSED

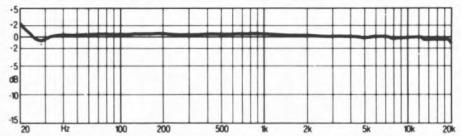
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



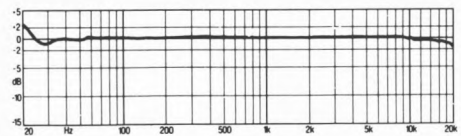
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

NAKAMICHI DRAGON

Continued from previous page

with metal tapes. All tapes can be accommodated, but some (dual layer?) types, like Maxell XL-IIIS and BASF CR-MII, never quite adjust out for the sort of ruler flat response shown in the graph.

Finally, seeing the slight lift up at 20Hz on the record-response graphs and noting the presence of a sub-sonic filter (on a cassette deck?), response to 1Hz was analysed.

Low frequency boost, to get flat bass response, results in a sub-sonic peak. This is tamed with a 10Hz notch filter (!) in the amplifiers. As a result of all this, there is residual +2dB boost at 15Hz. Selecting the sub-sonic filter reduces it and output level down.

SOUND QUALITY

Perhaps over-ambitiously, we expected TDK MA to give an absolutely identical copy of various digital recordings, but couldn't in the end satisfy ourselves that there wasn't just the slightest hint of tizziness at high frequencies. However, this really was a minor — almost subliminal — blemish. I do believe the machine is over-biased for metal, but most listeners would be more than satisfied with metal recordings.

Various pseudo-chromes, like TDK SA, were tried but their slightly 'creamy' sounding opaqueness, although pleasant, was too limiting we felt. BASF CR-MII is the best choice and by careful setting of record level (+3dB maximum) it gave fine clarity, sharp transients and little hiss, without Dolby, whilst not suffering compression on musical crescendos or the tizziness noted with metal. The best compromise was Dolby B, which 'slowed' transients slightly but allowed lower record level before hiss became evident. Dolby C gave too much of an enclosed sound. With Dolby B it is best to use 120 μ S equalisation with chrome,

since the raised treble overload headroom this provides gives cleaner transients.

It was ironic that we really were most impressed by simple TDK AD ferric tape. Expecting less, we were surprised at how, with Dolby B, the *Dragon* reproduced fine treble detail, well defined attack on transients and a smoothness that is uncommon with ferric. There was slight feathering on piano and some pollution of steady organ notes, possibly due to the cassette mechanics. Nevertheless, the end result was remarkable.

SUMMARY

The main thrust of the *Dragon's* design rationale has been towards obtaining perfect fidelity from pre-recorded cassettes, and to achieve this it has automatic head azimuth adjustment of astonishing complexity and resolution. Until the arrival of the CR7 it provided definitive sound quality from all musicassettes. The sense of clarity and sharp, stable imaging re-defines what the medium is capable of.

Recordings reached a very high standard too, depending as much upon the tape selected and accuracy of set-up as inherent machine performance. To say the least this is an extremely impressive cassette deck.

It was in the reproduction of musicassettes that this deck really did excel. Rather than just 'more of the same, but better', the *Dragon* gave a complete step up in this area by producing unusually sharp stereo images. It had all the usual attributes of image depth, pitch steadiness and the ability to separate music from background hiss, which we have noticed with other very expensive decks. For those who want or have to hear (for professional reasons) what is on a musicassette, the *Dragon's* only rival is the newer Nakamichi CR/ which shows still further improvements at low frequencies in particular.

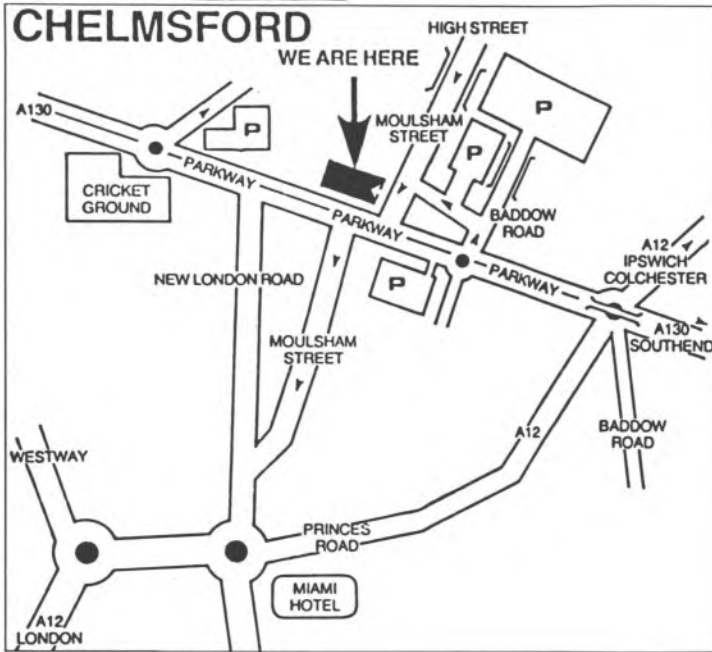
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ONKYO TA-2028

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The Onkyo TA-2028 incorporates a variety of features found on both budget and more expensive decks, in a simple, clean package that is easy and straightforward to use. Legends and symbols are used intelligently, particularly when combined on the transport controls. The logic controlled transport works smoothly and quickly, if a trifle loudly, accepting commands including 'punch-in' record with ease.

Tape selection is automatic and has a bright LED status display, a useful facility often omitted from more up-market machines. Dolby B and C are selected by interactive combination buttons, with status display back up. The peak level LED display has good range and reasonable resolution, and record levels are set by sliders with a good, solid feel.

A particularly useful facility is user-adjustable bias control which gives improved tape/deck compatibility. Also included are music search (which scans the tape and plays the first 10 seconds or so of each track), track or side repeat (so you can play your favourite track to death), auto-space (finds the gaps between tracks), and both mike and 'phones sockets.

LAB REPORT

Looking back over my observations and test results on the preceding TA-2027, both distor-

tion and head overload levels (which are related phenomena) have worsened for the TA-2028, So performance has dropped from good to mediocre in terms of maximum recordable levels. The 2028 shows distinct limitations in recording onto metal tape, producing an overload (MOL) value of just +1.5dB some 2-3dB poorer than usual. Chrome was not very successful either, but the low bias required for ferric tape minimised the problem. Overall distortion at 0VU (equivalent to Dolby flux) on metal tape measured 2.8% — a relatively high value directly due to the head's limitations. Low record levels should therefore be used with metal tape, but this will of course make hiss more obvious.

Record/replay frequency response was flat with all three tape types. Variable bias affects only ferric and chrome tapes, giving enough variation to counteract the more awkward tapes like BASF CR-MII and Thats FX. The slight tip upward in treble output seen with metal tape is best counteracted by using Maxell MX. Replay equalisation and head azimuth both proved well set, resulting in a reasonably flat replay frequency response — still a comparative rarity on Japanese cassette decks. This eliminates the dull, 'woolly' sound so commonly heard with pre-recorded tapes. Onkyo's transport worked well, but exhibited both capstan wow and distributed low rate flutter at low levels; only personal

auditioning can determine whether this will be intrusive or not.

SOUND QUALITY

At the centre bias position ferric (TDK AD) gave a bright 'edgy' sound with coarse treble and some 'spitch' on sibilance, perhaps due to distortion. Increasing the bias softened the aggressive treble but there was still a 'rough' quality; again high distortion is the suspect. Chrome (BASF CR-EII) had a smooth quality with natural treble and none of the 'jitteriness' heard with TDK AD. Good speed stability was evident on piano, although there was some 'wateriness' of pitch. Maxell MX (metal) provided good clarity at low levels, though it became slightly coarse at the top end. Provided record levels are kept down there is even tonal balance, but dynamic range is limited because of poor high level performance.

Performance with music cassette was very poor, the deck sounding bland and congested at high levels. Transient attack was almost non-existent and there was very little upper treble.

SUMMARY

The TA-2028 neatly combines features found on both budget and up-market machines, including user adjustable bias and automatic tape selection with a clear status display. Good presentation was let down by poor distortion and head overload performance, resulting in low maximum recording levels with all tape types.

TEST RESULTS

Replay of pre-recorded music cassettes

Frequency response _____ 30Hz-17.0kHz very good
 Speed accuracy _____ +0.6% good
 Noise _____ -61dB good

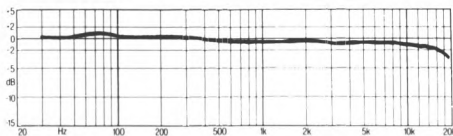
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-14.5kHz good
 Frequency response, chrome _____ 27Hz-15.5kHz very good
 Frequency response, metal _____ 27Hz-16.0kHz very good
 Stereo separation _____ -49dB average
 Distortion _____ 2.8% very poor
 Noise _____ -55dB very good
 Speed variation _____ 0.08% very good
 Modulation noise _____ -36dB poor
 Flutter energy (band level) _____ -27dB good
 MOL, ferric, 315Hz/10kHz _____ +4.0dB/-9.0dB average
 MOL, chrome, 315Hz/10kHz _____ -0.5dB/-9.0dB poor
 MOL, metal, 315Hz/10kHz _____ +1.5dB/-1.0dB very poor

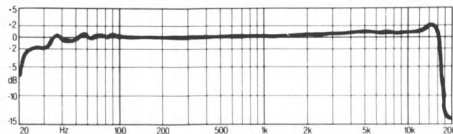
Input/output performance

Line in (sensitivity/overload) _____ 60mV/>3V
 Mic input (sensitivity/overload) _____ 0.8mV/30mV
 Output _____ 500mV
 Typical price inc VAT _____ £180

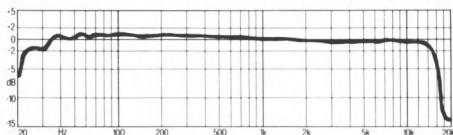
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



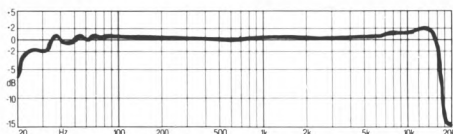
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

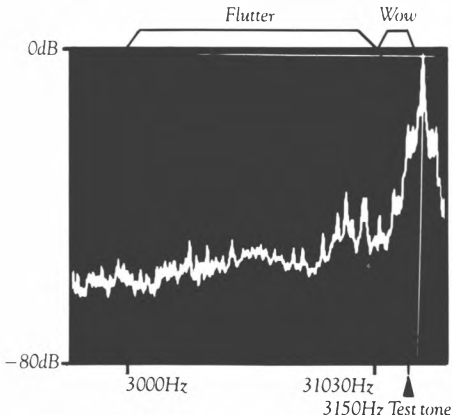


Type II (chrome or pseudochrome)



Type IV (metal)

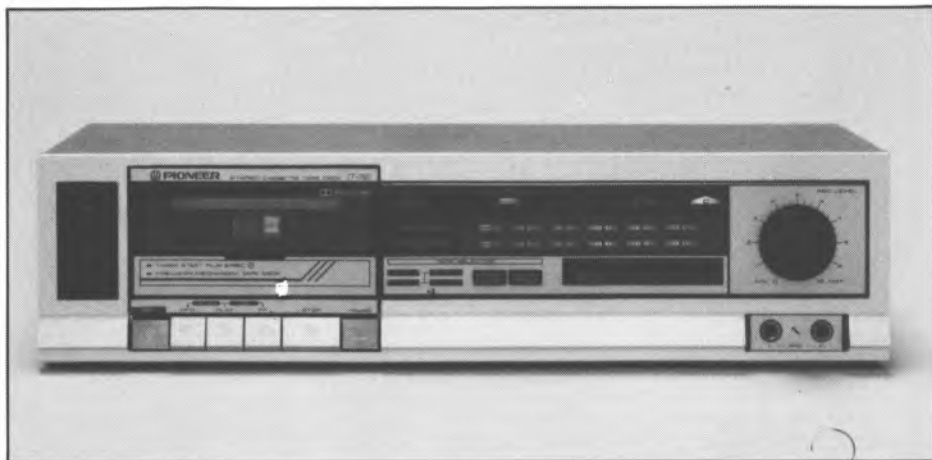
WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



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Now that black finish has become almost universally accepted for hi-fi equipment, the bright aluminium of Pioneer's CT-760 looks unusual, though not unattractive. However, the potential benefit of good lettering legibility has not been fully exploited. The black lettering identifying the transport controls was easily read, but the tape selector legends were nearly illegible. Together with the common but confusing use of twin interactive combination selector buttons, this made the CT-760 very awkward to use in this respect. Much the same arrangement is used for Dolby selection too, but indicator lights help alleviate confusion here.

Whilst other cassette decks are shedding their mike inputs, Pioneer retain them on the '760. The mechanically-linked transport controls with their inevitably clanky feel allowed direct change from fast forward to reverse and the like, but not fast reverse straight from record. Recording starts immediately on pressing just the record button, which risks accidental erasure of home recordings. The record level displays use five indicators per channel, two orange and three red.

LAB REPORT

OVU is set low, at 3dB below Dolby flux, which discourages over-recording at the expense of some increase in hiss, a common feature of budget decks. However, tests showed that the '760 got as much signal on to tape as its rivals, and was quite respectable in this area of performance. As usual, ferric tape manages best in the midrange, whilst metal is superior at high frequencies. Sensitivity adjustment was incorrect for European chrome-bias tapes, favouring the very sensitive types from Japanese manufacturers TDK; SA-X gave correct Dolby tracking.

Frequency response was accurately set for blank tapes, the graphs showing some treble loss with ferric. In practice this is easily countered by using a quality ferric with rising treble, like TDK AD-X or BASF LH-XI. The slow bass roll-off seen in the traces occurred also in the replay response, so both recordings and pre-recorded tapes had a bass-light quality.

Although measured treble fell off in the replay frequency response was slight, musicassettes still sounded dull and smeared. The '760 was worse than expected in this area.

SOUND QUALITY

Recordings confirmed the accuracy of adjustment giving a smooth, natural tonal balance. However, listening tests also revealed inconstant speed. There was around double the average amount of speed drift, which led to a wow problem. The effect wasn't severe by any means, just some slight unsteadiness or 'wateriness' of pitch on piano robbing the sound of solidity, and producing a 'jelly-like' quality.

Alongside the wow was flutter which adds impurity or dirtiness. Again though, we didn't feel this was a significant problem during listening tests, considering the price of the deck. Pioneer have got both hiss and hum down to inaudible levels in the replay amps. Recordings on metal tape reached a good standard, but ferric sounded somewhat 'ragged'.

SUMMARY

For a budget deck the '760 does reasonably well. Styling is a trifle wayward, with bright aluminium finish instead of the customary black, plus a failure to ensure that all the legends are legible. There is also the poor replay-only performance which is almost endemic among cheaper machines. Due to speed instability, recordings suffered noticeable, though not severe 'wateriness' of pitch.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-11.0kHz good
 Speed accuracy _____ +1.2% average
 Noise _____ -60dB good

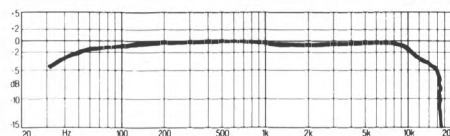
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-14.5kHz good
 Frequency response, chrome _____ 27Hz-16.0kHz very good
 Frequency response, metal _____ 27Hz-16.0kHz very good
 Stereo separation _____ -48dB average
 Distortion _____ 1.4% average
 Noise _____ -54dB good
 Speed variation _____ 0.13% very good
 Modulation noise _____ -34dB very poor
 Flutter energy (band level) _____ -27dB good
 MOL, ferric, 315Hz/10kHz _____ +5.0dB/-9.0dB average
 MOL, chrome, 315Hz/10kHz _____ -0.6dB/-7.0dB poor
 MOL, metal, 315Hz/10kHz _____ +1.8dB/+0.0dB very poor

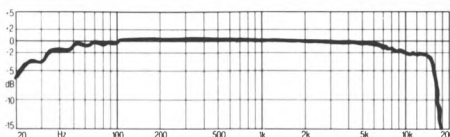
Input/output performance

Line in (sensitivity/overload) _____ 60mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 340mV
 Typical price inc VAT _____ £100

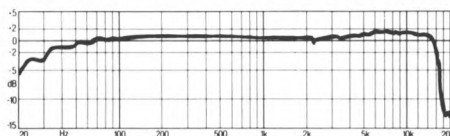
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



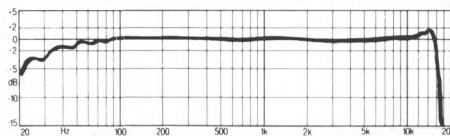
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

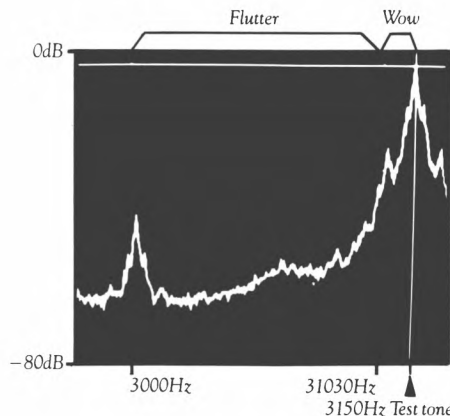


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



PIIONEER CT-S99WR

PIIONEER HIGH FIDELITY (GB) LTD, FIELD, WAY, GREENFORD, MIDDLESEX UB6 8UZ.

TEL: 01-575 5757



The CT-S99WR is a twin auto-reverse dubbing deck armed with numerous facilities, operated by a mass of dinky little controls closely packaged together on the front panel. Synchro-dubbing, parallel record, relay or continuous play/record, and music programming are all selected using miniature buttons which are too small for comfort. However, they do have status displays. The logic controlled transport works smoothly and is exceptionally quiet, accepting unusual commands including one-touch 'punch-in' record for both decks. The transport controls also double as programme selectors, so that up to ten tracks can be preselected for either play or record. Tape direction is selected by forward or reverse play panels on the transport keyboard, and is given a bright LED display on the cassette lids. However, each deck has to be switch-selected before it can be used — a difficulty not found on other dubbing decks. Tape type selection is automatic, though it has no display. Dolby B and C and dbx are all manually selected and have status display.

LAB REPORT

Like many dubbing decks, the CT-S99WR had well maintained treble output right up to 18kHz — a performance far better than most conventional decks. Consistency was good, both decks

being virtually identical in measured replay response, playing forward and backward.

Speed stability was equally good on both transports, in both directions of play. There was little evidence of drift and wow on the spectral analysis. Only listening tests can be the final arbiter with this complex phenomenon. There is an obvious flutter spike, which may add some coarseness, but otherwise both transports performed quite respectably.

The tape head in the normal recorder managed to get quite high signal levels onto all three tape types, making a better job than expected with metal tape. (My scepticism comes from the likelihood of manufacturers fitting poor heads to keep costs down, because dubbing decks are such complex devices.) A good head generates little distortion at the 0VU recording level commonly adopted these days (Dolby flux), and the CT-S99WR was no exception, with an overall of 0.9% on metal tape.

Frequency response with blank tapes measured flat as the graphs show, except with chrome where distinct treble lift is evident. Frequency response of a tape after dubbing (metal-to-metal) was reasonably flat, though this won't be the case with chromes.

SOUND QUALITY

The CT-S99 managed to avoid the dull, bland

sound often found with musicassettes, but it still lacked overall dynamism and 'punch,' sounding a little weak, flat and short of bass.

Maxell MX (metal) sounded clear and clean with virtually no messiness at higher levels, but tonal balance suffered from emphasised treble and withdrawn bass, so the overall effect was bright and lacking solidity. Piano pitch sounded thin on chrome (BASF CR-EII) but reasonably stable, while TDK SA treble was fiercely accentuated, particularly at higher levels, and compounded by vague almost 'transparent' bass, generating an unpleasant thinness. Ferric (TDK AD) was handled more forcefully, though bass still sounded vague — even bland. Transients were noticeably softened, but not to the point where this became aggravating.

Unfortunately, dubbing was not particularly successful. Metal-to-metal sounded thin and vague, lacked 'punch' and clear separation between instruments.

SUMMARY

This machine suffered from an overcomplicated design, with facilities such as music programming sharing controls which are generally too small and closely packed for easy use. Performance was reasonable, especially with musicassettes, though all tape types tended to sound thin. Dubbing quality was poor, accentuating the vagueness encountered with Maxell MX.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-16.0kHz very good
 Speed accuracy _____ +0.5% good
 Noise _____ -61dB good

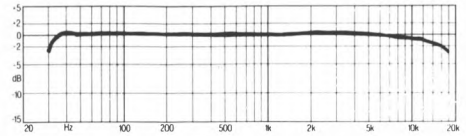
Record/replay using blank tape

Frequency response, ferric _____ 0Hz-0.0kHz
 Frequency response, chrome _____ 0Hz-0.0kHz
 Frequency response, metal _____ 0Hz-0.0kHz
 Stereo separation _____ -48dB average
 Distortion _____ 0.9% good
 Noise _____ -54dB very good
 Speed variation _____ 0.08% very good
 Modulation noise _____ -41dB average
 Flutter energy (band level) _____ -2.3dB average
 MOL, ferric, 315Hz/10kHz _____ +4.0dB/-10.0dB average
 MOL, chrome, 315Hz/10kHz _____ +1.0dB/-7.0dB poor
 MOL, metal, 315Hz/10kHz _____ +2.5dB/-0.5dB poor

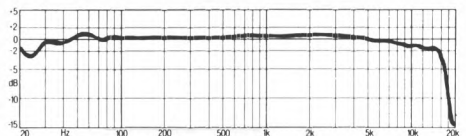
Input/output performance

Line in (sensitivity/overload) _____ 65mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 350mV
 Typical price inc VAT _____ £400

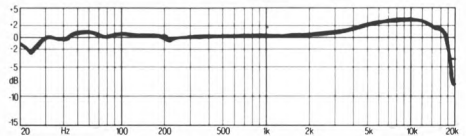
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



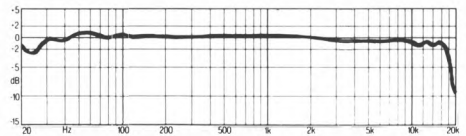
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

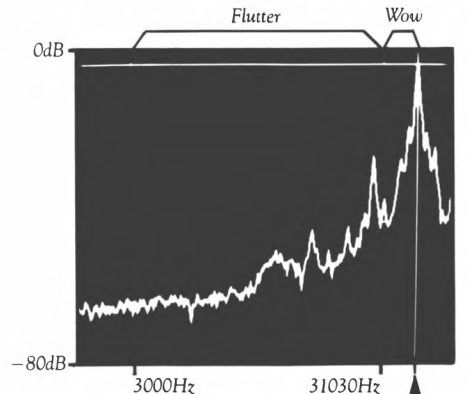


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



PIONEER CT-A7X

PIONEER HIGH FIDELITY (GB) LTD, 1-6 FIELD WAY, GREENFORD, MIDDLESEX.

TEL: 01-575 5757



This model has been designed as a straightforward, no-compromise high-quality deck. Consequently it lacks all gizmos like auto-reverse and computer tape-tuning. Pioneer have stuck to the usual arrangement of independent (siamesed) record and replay heads, providing off-tape monitoring whilst recording. A dual-capstan transport is used too, this drive method being effective at suppressing flutter in particular.

Instead of offering numerous gadgets, the CT-A7X is beautifully built and finished. It has a well thought out control layout and the transport has very comprehensive logic. It allowed recording to be started direct from fast reverse and from playing ('punch-in' recording). The 'return' button could be used to interrupt any mode and cause the transport to wind to zero on the counter.

Bright blue fluorescent record-level meters cover a range from -20dB to $+10\text{dB}$, relative to 0VU set 2dB below Dolby flux — a somewhat low setting. Dolby B and C are included, plus a music scan system based on gap searching and a timer switch that allows automatic start from an external timer.

The cassette door slides open quietly and, sensing when a cassette has been inserted, shuts itself automatically!

LAB REPORT

There was more treble wavering than expected at high frequencies, when making replay tests with the IEC international standard test tape. The variations turned out to be 1.5dB maximum from this tape and 1dB from a 10kHz recording on chrome: not bad, but not so good either, and more like a budget than a prestige model. Replay frequency response was correct to 10kHz , but fell away at higher frequencies.

Replay hiss and hum levels were low — especially hum at -74dB . Replay speed was set a bit fast at $+1\%$, but replay speed stability from the dual-capstan transport was excellent at around 0.03% total (DIN-weighted) wow and flutter. Much the same performance was achieved when recording, additive effects increasing the wow slightly to 0.05% . Like all good dual-capstan transports, this design pushed modulation noise down around 5dB lower than usual (-43dB in a 1kHz - 3kHz band) and generated almost no flutter. Whereas mediocre dual capstan transports may often wow slightly, due to capstan eccentricity and the like, the CT-A7X exhibited little wow and what did exist was evenly distributed and difficult to pin down subjectively.

Measurement surprisingly showed that the head disliked strong bass signals, producing 3% distortion at peak record level (ie 0VU). At the indicated metal tape recording level ($+5$), 10%

third harmonic distortion was measured. All tape overload (MOL) levels were low too, although bias had obviously been set low to keep the treble ceiling up. A midband overload (MOL, 315Hz) value for chrome tape of -2.5dB was worse than that of most budget decks, and metal wasn't very impressive at $+2.5\text{dB}$ either.

A final disappointment on the CTA7X was extremely poor record-equalisation accuracy for chrome tape. All chromes available in the UK will sound far too bright on this machine. Metals like TDK MA and Sony ES will also sound over-bright, but Maxell MX matches properly.

SOUND QUALITY

With TDK MA metal tape, the A7 sounded 'busy' in the treble and had weak lower bass. There was no sign of coarseness or unpleasantness in the treble though. Maxell MX metal gave a natural tonal balance and sweet treble. Sound quality was excellent if record levels were not pushed up unduly, except that deep bass was again weak. With TDK SA chrome, vocals were pushed forward in their upper registers, due to a plateau of high frequency emphasis. The sound soon became muddled, due to distortion at high levels. It was a choice between this or some hiss. Ferric (TDK AD) sounded smooth and relaxed. Treble was free of 'graininess' or 'coarseness,' but did 'splash' a bit. Results were considered excellent for ferric tape.

Musicasette had a thin, gutless sound, due to lack of deep bass again. There was little depth dimensioning and poor insight into the music. Imaging was mediocre for an expensive deck and transients lacked crispness. The 'A7X' was peculiarly unimpressive with musicassettes.

SUMMARY

Ergonomic design of the CTA7X was first class, and automatic tape-type sensing proved an asset. Under test, though, it showed some surprising weaknesses. Replay response should have been more accurate and HF stability better. Adjustment for blank tapes — especially chrome — was poor. No user-adjustable bias is provided and overload ceilings were also poor.

Sound quality with chrome tape was tonally unbalanced but clean. Results with Maxell MX metal were fine if record levels were kept down,

but then hiss became a bit more apparent. Ferric gave excellent results. Musicasset reproduction should have been better at this price level.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 20Hz-14.0kHz good
 Speed accuracy _____ +1.0% average
 Noise _____ -60dB good

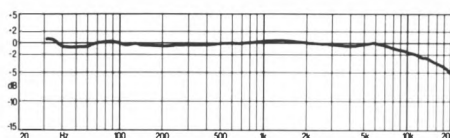
Record/replay using blank tape

Frequency response, ferric _____ 30Hz-17.0kHz very good
 Frequency response, chrome _____ 30Hz-5.0kHz very good
 Frequency response, metal _____ 28Hz-20.0kHz very good
 Stereo separation _____ -52dB good
 Distortion _____ 1.4% average
 Noise _____ -53dB good
 Speed variation _____ 0.05% very good
 Modulation noise _____ -43dB very good
 Flutter energy (band level) _____ -36dB very good
 MOL, ferric, 315Hz/10kHz _____ +3.0dB/-4.0dB good
 MOL, chrome, 315Hz/10kHz _____ -2.5dB/-5.0dB very poor
 MOL, metal, 315Hz/10kHz _____ +2.5dB/+1.0dB poor

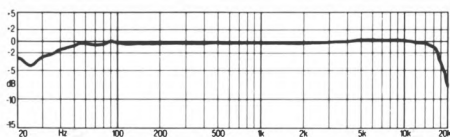
Input/output performance

Line in (sensitivity/overload) _____ 60mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 700mV
 Typical price inc VAT _____ £440
 REASSESSED

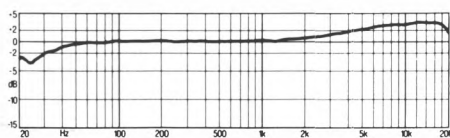
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



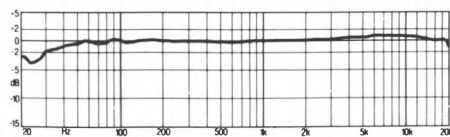
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

RECOMMENDED

PIONEER CT-A9X

PIONEER HIGH FIDELITY (GB) LTD, 1-6 FIELD WAY, GREENFORD, MIDDLESEX.

TEL: 01-575 5757



Now in fashionable black finish and given an 'X' suffix, this deck was originally tested as the CT-A9. Pioneer have largely resisted the temptation to load the deck with gadgets, instead going for performance features, such as closed-loop dual-capstan drive. To this end the deck has three heads for off-tape monitoring whilst recording, a tape tuning system with standard, under- and over-bias conditions available, and the system also adjusts sensitivity and record equalisation.

Tape type selection is automatic, which prevents selection error. The record level displays are very bright green and read peaks accurately, but 0VU has been set 2dB below Dolby flux, which is a bit low. In their handbook, though, Pioneer do say that peaks can run up to Dolby level.

The cassette window is back lit and the tape counter also shows time remaining. Logic control allowed 'punch-in' recording and immediate fast rewind out of record mode. A 'tape return' button would stop play or recording and start rewind back to zero on the counter. This was simple and useful.

LAB REPORT

Factory-set bias, obtained by not using the auto tape tuning facility, gave very high treble saturation

levels, but slightly reduced mid-band overload. Consistency of performance between tape types suggested Pioneer have adjusted this deck carefully and deliberately to obtain better treble performance, at the expense of mid-band headroom — a sensible approach. Standard auto-bias ('peak') set bias even lower, giving ferric tape almost metal performance in treble saturation headroom. All mid-band overload levels (MOLs) were above 0VU, +3dB to +7dB with ferric, chrome and metal, so adequate headroom is maintained if advised maximum record levels are used.

Record/replay frequency responses proved flat with all tape types. Especially notable was lack of rising treble with metal tape; this avoids nasties like 'spitching' and hardness. Pioneer's tape tuning system was more accurate than many in this respect, but Dolby action increased treble loss at low levels.

We had to be impressed by the transport. There were virtually no flutter side-bands, resulting in an extremely low equivalent band level value of -38dB flutter distortion. This is 1.2%, compared with around 10% from most decks and up to 30% from the worst. Equally, modulation noise was an exceptionally low -43dB, compared with a typical -38dB. Wow was virtually eliminated too. Spectrum analysis of the demodulated wow signal showed only 6Hz

and 12Hz components and these were at an extremely low level. Wow measured 0.02%, flutter 0.06% and drift 0.03% — amazing results! Note that this deck is more speed stable than any turntable can ever hope to be and almost as stable as a CD player!

Replay frequency response was almost ruler flat from 30Hz up to 18kHz, divergence being 0.5dB or less; the test tape isn't guaranteed more accurate than this. Replay speed was correct, but head height a bit out of adjustment. There was 1dB-2dB more Dolby B treble loss at low levels than expected.

SOUND QUALITY

TDK MA tape ('peak' auto-bias) gave an exceptionally smooth, stable sound — even on difficult orchestral peaks. It was totally relaxing, but some detail and insight was missing from violin, in comparison with the CD original. The natural sibilance in vocals and speech was slightly muted too. Piano reproduced with astonishing freedom and naturalness, apparently unrelated to background tape hiss, due in no small part to lack of modulation noise. Pitch stability was perfect, although some 'wiriness' was just discernible with organ.

Chrome tape (TDK SA) gave similar results, but was a bit blander, woollier and soft. Fine treble detail was confused or lost, partly from falling treble due to Dolby action. BASF SuperChrom IIS, under-biased, gave results as good as metal.

Ferric tape (TDK AD) gave astonishing results. Less soft and woolly than chrome (TDK SA), the ferric tape's treble detail was maintained as if saturation was not occurring at all. Hiss was not a problem.

Musicassette replay quality was extremely good, but fell well short of the musical insight and image solidity of our reference Nakamichi ZX-9, which was a surprise. Tonal balance was correct, but there was a vagueness to the sound that made it uninvolving.

SUMMARY

The CTA9X may not look beautiful, but it was easy to use and produces startling recordings with ferric and metal tape in particular. Fidelity with pre-recorded cassettes was excellent, even though not reaching the highest standards.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 25Hz-20.0kHz very good
 Speed accuracy _____ +0.3% very good

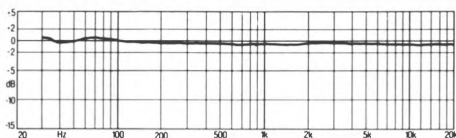
Record/replay using blank tape

Frequency response, ferric _____ 30Hz-20.0kHz very good
 Frequency response, chrome _____ 25Hz-16.0kHz very good
 Frequency response, metal _____ 25Hz-20.0kHz very good
 Stereo separation _____ -52dB average
 Distortion _____ 1.4% average
 Tape hiss, ferric _____ -66dB average
 Tape hiss, chrome _____ -68dB average
 Tape hiss, metal _____ -67dB average
 Speed variation (wow and flutters) _____ 0.02% very good
 Modulation noise _____ -43dB very good
 Flutter energy (band level) _____ -38dB average
 MOL, ferric, 315Hz/10kHz _____ +1.2dB/-4.4dB poor
 MOL, chrome, 315Hz/10kHz _____ +0.2dB/-6.4dB average
 MOL, metal, 315Hz/10kHz _____ +1.8dB/-0.6dB poor

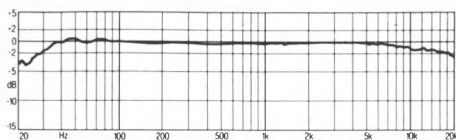
Input/output performance

Line in (sensitivity/overload) _____ 50mV/>-V
 Mic input (sensitivity/overload) _____ None
 Output _____ 580mV
 Typical price inc VAT _____ £700
 REASSESSED

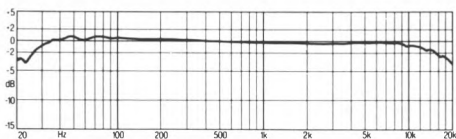
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



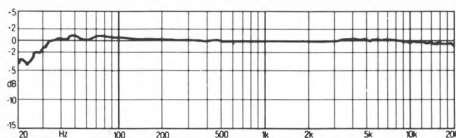
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

RECOMMENDED

REVOX B215

FW.O. BAUCH, 49 THEOBALD SREET, BOREHAMWOOD, HERTS WD2 4RZ.

TEL: 01-953 0091



Like its predecessor the *B710 MkII*, this machine has been designed as much for studio as for home use. It is a no-compromise machine at a no-compromise price, solidly built and incorporating some uniquely useful features. The automatic tape tuning properly adjusts bias, record equalisation and record-gain, holding the values in non-volatile memories for instant recall when changing between tapes. Tests showed that all tapes are tolerated, including awkward ones like BASF *CR-II* (super-chrome). Automatic tape sensing is used too, but with manual override so, for example, chrome tape can be recorded with 120 μ S equalisation.

A sophisticated tape 'counter' in fact measures reel speeds and computes elapsed time, allowing time points to be found with reasonable accuracy on any cassette, without the need to reel back to the start. Allied to this system is the ability to memorise two time location positions (called LOC1 and LOC2) which can be returned to, or the machine can be asked to find a specified time point.

Full logic control of the transport is provided, allowing 'punch-in' record. Revox use their own twin capstan mechanism which has no fewer than four motors — there are independent speed-controlled direct-drive motors for each capstan and separate motors for each reel. Siamesed independent record and playback heads give off-tape monitoring. Dolby HX Pro improves on the limited treble overload (saturation) performance of the *B710 MkII* which we noted in 1984. Dolby B and C are provided.

Infra-red remote control is available, and there is a serial link for wire-transmitted commands. No mike sockets are provided though, dedicated external units being necessary. After careful manual-reading and some acclimatisation, the *B215* proved easy to use, but its operating sequences are not necessarily self-evident, because of strong internal logic. It was a case of 'easy — once you know how'. The transport mechanism, which is an engineering masterpiece, moves with the speed and quiet precision of the best.

LAB REPORT

Revox take the same view of IEC replay response as Nakamichi, ignoring the tape as a standard and using a theoretical curve instead. This results in rising treble above 14kHz. Subjectively, the effect is slight but beneficial, as pre-recorded musicassettes acquire good transient definition and sharp imaging — all other things being equal.

Speed accuracy proved adequate at 0.5% fast, and replay speed stability was extremely good at 0.03% wow and flutter (DIN weighted). At -58dB the replay amps had a bit more hiss than some, but tape hiss will exceed this figure so it is acceptable. There was some hum, measuring -64dB at 100Hz and -66dB at 150Hz, and this could be heard under critical conditions. Dolby B replay tracking was excellent.

The LCD record level meters have 0VU at Dolby level. Recordings to this level were unaffected by hiss from either the record or replay amps, Dolby C giving -19dB of noise reduction, reducing hiss to -72dB with BASF chrome, for example. Hum performance was mediocre, being identical to the replay-only results. Record overload levels (MOL and saturation) are now very good. The computer tuning system gave a high degree of repeatability in its settings and we couldn't fault it. As a consequence, tapes always gave the same performance, even after repeated runing; some systems are erratic. Dolby tracking was near-perfect and frequency response with all tapes ruler-flat. This was a fine and consistently repeated performance. Spectral analysis showed negligible flutter with BASF's latest chrome tapes, but slight capstan wow at 5Hz and 10Hz.

Continued over page ►

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response	22Hz-20.0kHz	very good
Speed accuracy	+0.5%	good
Noise	-58dB	good

Record/replay using blank tape

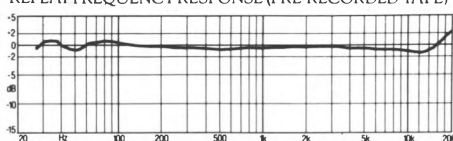
Frequency response, ferric	26Hz-20.0kHz	very good
Frequency response, chrome	26Hz-20.0kHz	very good
Frequency response, metal	26Hz-20.0kHz	very good
Stereo separation	-53dB	good
Speed variation	0.03%	very good
Modulation noise	-44dB	very good
Flutter energy (band level)	-39dB	very good
MOL, ferric, 315Hz/10kHz	+2.5dB/-1.8dB	average
MOL, chrome, 315Hz/10kHz	+0.5dB/-5.0dB	average
MOL, metal, 315Hz/10kHz	+4.0dB/-1.2dB	good

Input/output performance

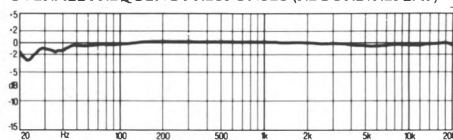
Line in (sensitivity/overload)	50mV/>3mV
Mic input (sensitivity/overload)	None
Output	750mV
Typical price inc VAT	£1311

REASSESSED

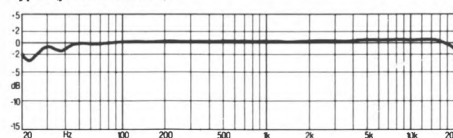
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



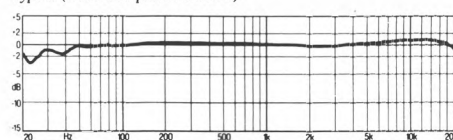
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

REVOX B215

Continued from previous page

SOUND QUALITY

Much like the previous *B710 MkII*, the *B215* provides recordings of fine clarity on metal tape. There was again the sense of listening only to electronic circuits, but with a bit of hiss added, only noticeable at high volume. Stereo imaging was needle sharp and perfectly steady too. We noticed very slight wow on critical organ music, which was a pity.

BASF super-chrome tape (BASF CR-II) again gave a perfectly even, steady sound, but with some slight softening and diffusion of treble on sustained high levels. It was only this feature that gave chrome away on difficult programme. Otherwise chrome had much the same lucid quality as metal tape on the *B215*.

Transients were best maintained without noise reduction and this was a perfectly valid option on the *B215*, because of its ability to accept BASF super-chrome, which has a very wide dynamic range.

Ferric recordings were slightly vague in treble

quality, possessing splashy transients, and some graininess, but this is usually the case. The *B215* still did a good job with most quality ferric tapes, especially Maxell *XL-IS*.

Musicassettes had a sense of depth about them; we felt this deck had the ability to delve into a performance even on relatively poor tapes — a feature noticed only on few other top quality machines. Poor tapes became entertaining, instead of beyond use. The quality of good musicassettes was properly revealed in relatively stable imaging, clean treble delivery, and a sense of solidity that added realism.

SUMMARY

A complex machine, the *Revox B215* had a fine measured performance, ignoring the slight blemishes of low level hum and capstan wow, which would rarely be heard. It gave impeccable sound quality both with recordings and with musicassettes, and is undoubtedly one of the best cassette machines available.

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SANSUI D-505

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MIDDLESEX. TEL: 01-575 1133



The D-505 is as close to being the twin sister of the 705 as you could get. The only facilities they do not share are independent bias adjustment and separate record/replay heads: the 705 has them, the 505 does not. However, although they look identical, the D-505 has a simpler single-capstan transport. Styling is clean and simple, with fascia lettering primarily identifying facilities rather than proclaiming internal technology. The imaginative use of bold symbols is effective on the pressure panels of the logic controlled transport which happily accepts a variety of commands, though not 'punch-in' record. Some facilities buttons had a tendency to wobble, while the AMPS facility for track-skipping was tedious to use. Happily, tape selection is automatic and has a clear illuminated status display. Despite interactive combination buttons Dolby selection also has a warning display. A niggling annoyance is the dual-concentric record-level control; the forward portion is too small and its action too stiff for easy handling.

LAB REPORT

Unfortunately, the review sample had been set up using premium quality Maxell cassette tapes. Whilst this superficially seems a good idea, it actually makes the deck incompatible with most

other brands and threatens to leave it high and dry when Maxell re-formulate (which with Japanese tape companies may happen several times a year). As a result, the D-505 has singularly non-flat recording frequency responses with standard (IEC Primary Reference Standard) ferric and chrome tapes in particular. I have been assured that in practice the decks will be set up using proper IEC Standard tapes, so presumably giving them the same sort of performance as most competitors. The average (40Hz, 300Hz and 3kHz) distortion figure of 4% is very high, due to a head incapable of accepting the high total flux needed to magnetise metal tape. An overload (MOL) value of 0dB underlines this point, being around 3dB lower than is common. Sansui decks tested in previous editions suffered the same weakness.

Replay response displays a falling treble output, causing a dull sound with pre-recorded tapes. Speed stability was fair, capstan wow at 7Hz being the dominant effect.

SOUND QUALITY

Musicassette replay sounded dull, as predicted by the falling treble in the replay response. However, it didn't sound as congested as anticipated, and was instead reasonably clear and unmuddled. Dynamics were 'flattened' and had a 'ragged' quality, probably due to head

overload distortion. A degree of pitch imprecision was also detected, but stereo imaging was fair.

Metal tape (TDK MA-X) was muddled and messy at high levels (to be expected given the head overload distortion). Tonal balance was good, but strings had a 'wiry' quality, and piano and organ had occasional pitch unsteadiness due to capstan wow. Chrome (new TDK SA) sounded dim, lacked clarity, had little transient attack or treble, and suffered obvious congestion and distortion. Ferric (TDK AD) sounded best of all, being clean and unmuddled with good treble, plus a stronger sense of insight than either metal or chrome.

SUMMARY

The 505 has excellent styling, being both clear and simple, while tape selection is automatic with a clear display. Performance on metal and chrome was affected by poor head quality and strong capstan wow. Musicassettes sounded better than expected, and ferric recordings were good.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-7.0kHz poor
 Speed accuracy _____ +0.8% good
 Noise _____ -60dB good

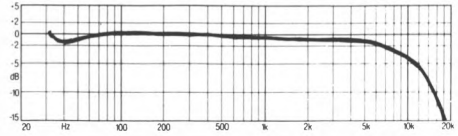
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-9.0kHz average
 Frequency response, chrome _____ 27Hz-11.0kHz good
 Frequency response, metal _____ 27Hz-16.0kHz very good
 Stereo separation _____ -60dB very good
 Distortion _____ 3.8% very poor
 Noise _____ -53dB good
 Speed variation _____ 0.09% very good
 Modulation noise _____ -42dB good
 Flutter energy (band level) _____ -32dB very good
 MOL, ferric, 315Hz/10kHz _____ +2.0dB/-7.0dB average
 MOL, chrome, 315Hz/10kHz _____ -1.5dB/-10.0dB very poor
 MOL, metal, 315Hz/10kHz _____ +0.0dB/-0.5dB very poor

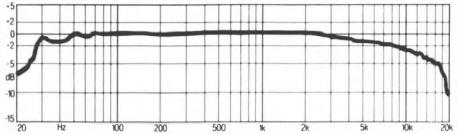
Input/output performance

Line in (sensitivity/overload) _____ 100mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 500mV
 Typical price inc VAT _____ £199

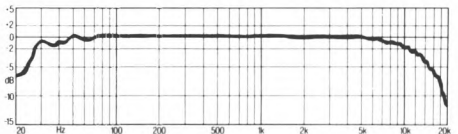
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



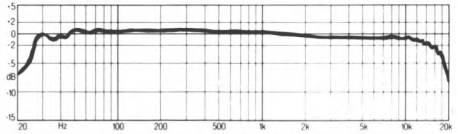
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

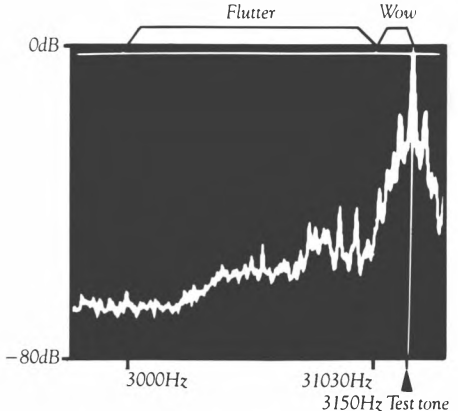


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



RECOMMENDED

SANSUI D-705

SANSUI (UK) LTD, UNIT 10A, LYON INDUSTRIAL ESTATE, ROCKWARE AVENUE, GREENFORD
MIDDLESEX. TEL: 01-573 1133



The first impression of Sansui's dual-capstan, three-head *D-705* is of the good clean lines, minimum of legends, and intelligent use of bold symbols. The latter identify much of the logic controlled transport, which blends proportionate pressure panels with smaller pressure bars in a happy mixture. Legends are reserved for the facilities arranged horizontally below the fluorescent display panel. The peak meter display has a wide range and good resolution. Tape selection is automatic and has status display. Dolby B and C have combination selection buttons, also with their own display.

Independent record and replay heads allow switching from the source sound to that going on to the tape during recording. Uncompromised by combining both roles, they offer better performance too. Independent bias control is used to improve tape matching when recording. However, closer inspection showed that not everything is rosy. The first flaw is the cassette lid which is operated by finger pressure: to begin with it failed to work at all, and thereafter only with much pressure and perseverance. (Sansui have even taken the trouble to warn users of this problem in their handbook!) The transport does allow 'punch-in' record, and though commands such as fast cue from reverse are accepted, the changeovers are noisily executed. Automatic

Music Programme Search allows track jumping of one preselected section up to 15 tracks before or after the one currently being played, but mistakes easily occur because the system is operated by repeated depression of the AMPS button.

LAB REPORT

Sansui UK appear to have 'tweaked' the *D-705* review sample, instead of leaving it in its factory state. By tuning it for top grade Maxell tapes, the deck is incompatible with standard (IEC aligned) hi-fi tapes, at least at 'centre' bias. The ferric and chrome record/replay responses consequently display falling treble giving dull sounding recordings. Luckily, the variable bias enables flat response to be restored. There was enough bias variation to accommodate 'difficult' tapes like BASF CR-MII and Thats FX, while a small variation with metal tape was also sufficient to cope with the slight differences that exist between brands.

Replay frequency response was quite accurate, indicating that the falling treble found on the *D-505* sister machine was due to factory azimuth misalignment. Sansui have used a combination head on this deck, and it is obviously a good one. Consequently, the premature overload (MOL) problem of the *505* has been overcome, and metal tape gave excellent results. Again,

bias tweaking has upset the MOL/SAT balance badly at centre bias, but backing off bias for flat response will restore matters. Speed stability of the dual capstan transport was good, if not exceptional, justifying its inclusion.

SOUND QUALITY

The quality of musicassettes was dull and bland, but there was a fair degree of insight into the performances, and the effect was not as bad as some.

Ferric (TDK AD) had good tonal balance after bias tweaking, sounding clean and stable. Good speed stability gave chrome (BASF CR-MII) a steady quality free of capstan wow coloration. Pitch was slightly 'watery' though not annoyingly so. However, treble was softened on high level signals, and soon got congested. Metal (Maxell MX) was good all round, giving a smooth steady sound with even treble, a natural tonal balance and fine clarity.

SUMMARY

Like the 505, styling is excellent, but unlike the 505, the 705 has decent heads. Combined with variable bias, this machine gave a good performance with all tape types, but was only average with musicassettes.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-16.0kHz very good
 Speed accuracy _____ +0.2% very good
 Noise _____ -60dB average

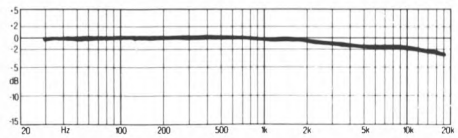
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-10.0kHz good
 Frequency response, chrome _____ 27Hz-15.0kHz very good
 Frequency response, metal _____ 27Hz-20.0kHz very good
 Stereo separation _____ -51dB good
 Distortion _____ -1.5% average
 Noise _____ -53dB good
 Speed variation _____ 0.06% very good
 Modulation noise _____ -41dB good
 Flutter energy (band level) _____ -28dB good
 MOL, ferric, 315Hz/10kHz _____ +5.0dB/-11.0dB poor
 MOL, chrome, 315Hz/10kHz _____ +3.0dB/-11.0dB poor
 MOL, metal, 315Hz/10kHz _____ +4.5dB/-1.0dB poor

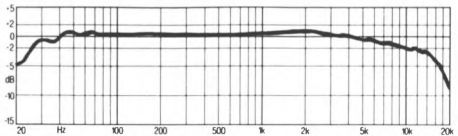
Input/output performance

Line in (sensitivity/overload) _____ 100mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 600mV
 Typical price inc VAT _____ £280

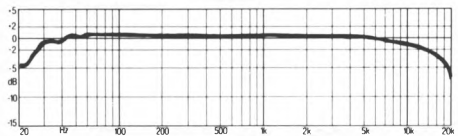
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



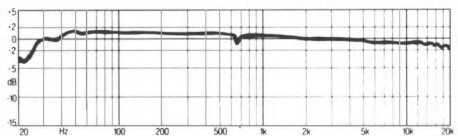
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

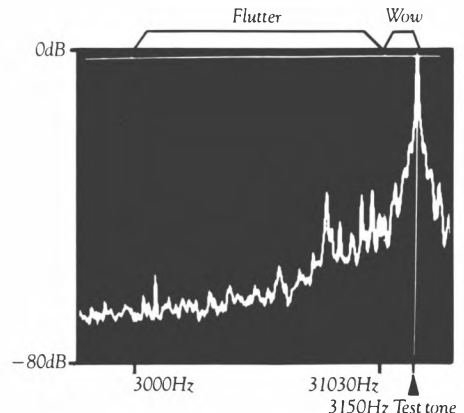


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



SONY TC-W230

SONY (UK) LTD, SONY HOUSE, SOUTH STREET, STAINES, MIDDLESEX TW18 4PF.

TEL: STAINES 61688



This budget dubbing deck from Sony is neatly and clearly styled, if a little cheaply finished by their normal standards. The mechanical transports are surprisingly quiet and respond well to unusual commands, such as record direct from fast reeling. The playback-only deck (A) has automatic tape selection, but the recording/playback deck (B) has manual selection, employing three independent buttons. This arrangement is better than the confusing permutations of the usual twin-button system, but there is no status display. Dolby B & C are fitted, again with no status display.

Despite having no warning for either tape type or Dolby, the TC-W230 does have a pair of garish red displays for normal and high speed dubbing. Synchronised dubbing and relay or continuous play are provided. An unusual and attractive liquid crystal peak level meter has white 'go' and red 'no-go' areas. It has good range, -20 to +8, with reasonable resolution. Record levels are set *via* twin sliders which are a little on the small side.

LAB REPORT

The large and clearly marked transport buttons proved very easy to use, but their somewhat clanky action suggested inexpensive mechanics, which proved to be the case. At 0.2%

peak-to-peak, drift was worse than usual these days and gave rise to a lot of wow. This can be seen in the spectrum analysis: notice how 'fat' the spike looks toward its base, due to random wow components. A fairly substantial amount of flutter can be seen further away to left of the 'spike' too. With wow measuring 0.15%, flutter 0.25% and flutter band energy -22dB — all high values — this transport will have some impact upon sound quality.

Distortion at 0VU (Dolby flux) on metal tape measured at 40 Hz, 300Hz and 3kHz, gave a single overall average 3.8%. This is higher than usual, due to a poor head unable to handle the high flux levels needed to record onto metal tape. Measurement of overload ceilings (MOLs and SATs) showed reasonable performance with ferric and chrome tapes, but poor results on metal tape, MOL measuring 0dB compared with 2dB-4dB or so on most other decks.

Recording frequency response with all three tapes types was very flat, demonstrating accurate factory adjustment. Dubbed copies had a flat frequency response as a result.

Replay frequency response was poor on both transports. Strong treble loss means that pre-recorded tapes will sound very dull and muffled.

SOUND QUALITY

Listening tests confirmed the lab findings. Piano

pitch on chrome (BASF CR-EII) sounded sloppy and vague, though not as 'drunken' as might have been expected. TDK SA had a slightly compressed dynamic range with a vague bottom end, made worse by boosted treble. Metal (Maxell MX) had a fair sense of clarity, but sounded mildly diffuse, with a marked tendency to muddle and messiness at high levels. Again, rising treble gave a bright, light impression, but not unpleasantly so. The effect of flutter was most marked on ferric (TDK AD), which sounded bright and edgy. Compressed dynamics and little or no bass made the sound too thin and weak with a decided lack of 'punch'. Transients were reasonably strong and clear, though they too were affected by compression.

Musicassettes sounded very dull and flat with severely falling treble. Dubbing copies were poor, exhibiting a dull, bland sound with compressed dynamics. These characteristics were even more marked at high speed, where dubs had little range, muted treble and increased blandness.

SUMMARY

For a budget deck the TC-W230 is neatly and clearly styled. Unfortunately performance proved less effective than appearance. A poor head resulted in early overload with metal tape, whilst wow and flutter reduced the quality for recordings on chrome and ferric tape. Typically, musicassettes lacked treble, resulting in a distinctly 'warm' sound. And the quality of dub copies was unimpressive.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-8.0kHz average
 Speed accuracy _____ +0.0 excellent
 Noise _____ -60dB good

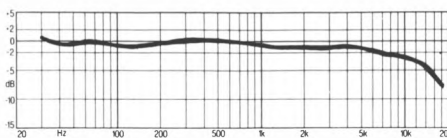
Record/replay using blank tape

Frequency response, ferric _____ 25Hz-15.0kHz very good
 Frequency response, chrome _____ 25Hz-15.0kHz very good
 Frequency response, metal _____ 25Hz-15.0kHz very good
 Stereo separation _____ -51dB good
 Distortion _____ 3.8% very poor
 Noise _____ -53dB good
 Speed variation _____ 0.15% very good
 Modulation noise _____ -39dB average
 Flutter energy (band level) _____ -22dB average
 MOL, ferric, 315Hz/10kHz _____ +2.5dB/-7.0dB average
 MOL, chrome, 315Hz/10kHz _____ +1.5dB/-7.0dB very poor
 MOL, metal, 315Hz/10kHz _____ +0.0dB/+0.0dB very poor

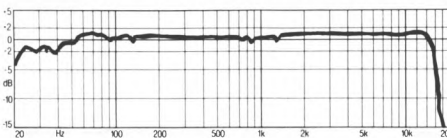
Input/output performance

Line in (sensitivity/overload) _____ 100mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 700mV
 Typical price inc VAT _____ £139

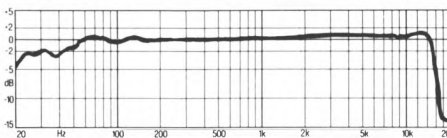
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



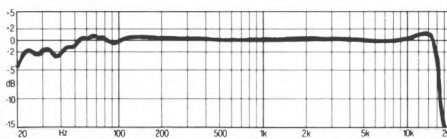
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

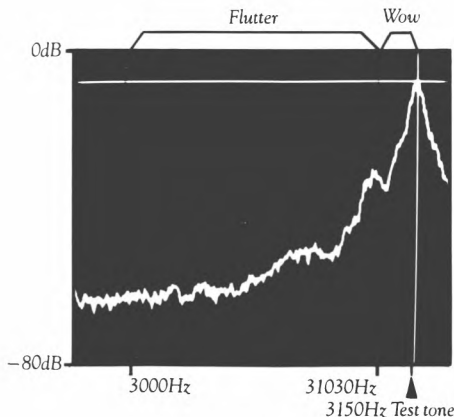


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



BEST BUY

SONY WALKMAN PROFESSIONAL WM-D6C

SONY (UK) LTD, SONY HOUSE, SOUTH STREET, STAINES, MIDDLESEX TW18 4PF.

TEL: STAINES 61688



Aimed at reporters, broadcasters and those who need to make very high quality live recordings 'on site' without a wagon load of back-up equipment, the *Walkman Pro* is relatively inexpensive as professional prices go. Though rather bulky for 'personal' headphone 'carry about' use, a car adaptor is optional, and those whose in-car systems can accept an extra signal source will find the *Pro* provides outstanding quality while being easily removable to avoid theft.

The *Pro* has Dolby B and C, and also records onto metal tape, as well as ferric and chrome. The capstan is quartz-locked for speed accuracy and stability, but the lock can be relaxed by flicking a switch whereupon speed may be varied. A small mechanical tape counter proved awkward to zero, but this is probably deliberate, to prevent accidental operation.

Whilst the *Walkman Pro* will record conventionally from a hi-fi amplifier, or *via* the very insensitive mike input, its natural role is hooked up for replay of musicassettes. Trying to record is a bit of a fiddle, although no more difficult at home than in the field. Connection into a hi-fi system requires a phono-to-jack adaptor lead, since inputs and outputs are 3.5mm stereo mini-jacks of the sort found on all *Walkmans*.

Powered condenser mikes must be used to

cope with the low mike input sensitivity of 200mV, and full gain was needed with the supplied optional Sony mike (*ECM-929LT*) to get *OVU* with speech from just a few feet away. Line jack levels may be inappropriate for some hi-fi amplifiers, though connection may also be made *via* mike and headphone sockets, taking care not to turn headphone volume up too far to avoid output amplifier clipping. The headphones supplied (*MDR-40*) were very thin and tinny-sounding; we used Sennheiser *HD40s* instead, in order to hear bass. The *Walkman Pro* is big by 'personal' standards at 18cms long, 9cms wide, and 4cms deep. It is also comparatively heavy, and uses four AA batteries. We used Sony's mains power unit and also tried a specialist heavy duty 'audiophile' power supply from Exposure Electronics, intended for stationary domestic use, and this gave improved bass performance.

LAB REPORT

The record level display used a single column of five red LEDs, *OVU* being placed very high at IEC 0dB Reference level (250nWb/M). (This is approximately 2dB above Dolby flux, the normal point for *OVU*.)

A laser amorphous head, gives respectable head overload figures (MOLs), even with metal tape. Bias had been set high partly to achieve

this, so compromising treble overload (SATs). I was surprised that the Pro could handle metal so well, all the same.

For top quality live recordings — and live recordings can be most impressive — the *Walkman Pro* is good enough to justify use of top quality metal tapes. However, whilst Sony ES metal is very quiet, watch out for its treble peak, which can add a 'sting' to recordings. The *Pro* has been adjusted to give flat frequency response with recordings made onto standard hi-fi tapes, like TDK MA-X, Maxell UD-II and TDK AD, as the graphs of performance with IEC Primary Reference Standard tapes show.

Replay-only frequency response was disappointingly inaccurate measuring — 2dB at 10kHz and with little upper treble above 12kHz. Pre-recorded musicassettes will therefore sound a bit 'soft' or dull.

Speed stability was astonishing. Drift was virtually unmeasurable, so there was virtually no wow. The spectrum analysis clearly shows how sharp the test tone 'spike' is at right. There was little flutter too. Recordings will therefore have 'solid' timing, and musicassettes will benefit too, with a well defined sense of tempo instead of the vague timing low rate wow introduces.

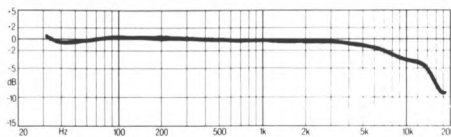
SOUND QUALITY

This machine proved quite a surprise. It produced recordings of astonishing quality, especially onto TDK AD ferric tape. There was a relaxed naturalness and excellent transient handling (Dolby B) to the sound, but diffuse high level treble as usual. Strangely, really good recorders somehow manage to make ferric tapes sound almost as good as metal. Chrome (BASF CR-EII) was light and bright sounding, but very clear, and again impressively smooth. Metal tape (Maxell MX) was a bit bright and aggressive, which was disappointing. However, the treble was clean, transients were very strong — as always with metal — and clarity superb.

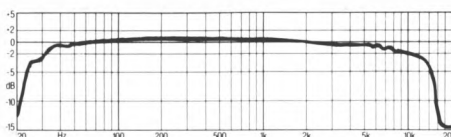
Musicassette replay indicated a fine head, since although there was obviously less treble than there should have been, and this noticeably affected inherently dull recordings, there was also good insight, lack of muddle, and clean high levels. Excellent speed stability gave both musicassettes and recordings really tight tempo,

Continued over the page

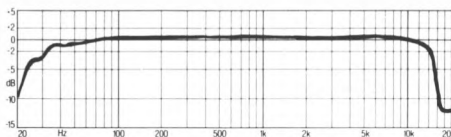
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



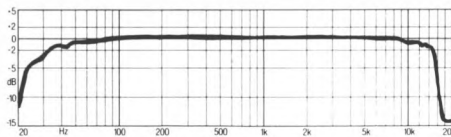
OVER ALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

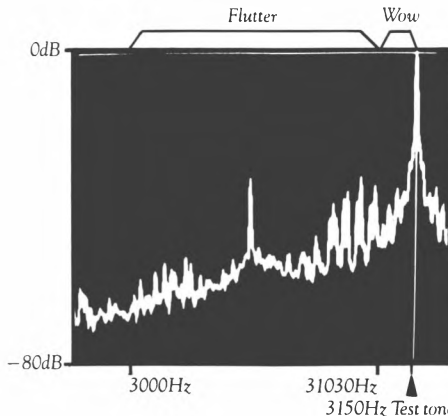


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



Sony WM-D6C

continued from previous page

banishing 'sloppiness' in the sound.

Live recordings on metal tape (Maxell MX) sounded bright, but this was probably due to the mike and tape. Natural sibilance in speech was emphasised, which was a pity, but at least there was no 'spitch.' Only slight, soft hiss could be heard when using Dolby C, probably from the mike's pre-amp. Quality was superb and, only a better mike was necessary to achieve the highest broadcast standards. Optional HF filtering in the mike might be useful.

SUMMARY

Used carefully, with allied equipment of very high quality, the *Walkman Pro* provides astonishing recordings, and replays pre-recorded tapes well too. I would like to see variable bias to cure some tape-match problems, especially with metal, plus an accurate replay response. Then it would rival the best mains powered recorders.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response	30Hz-8.0kHz	average
Speed accuracy	+0.3%	very good
Noise	-65dB	very good

Record/replay using blank tape

Frequency response, ferric	27Hz-12.0kHz	good
Frequency response, chrome	27Hz-14.5kHz	good
Frequency response, metal	27Hz-15.0kHz	very good
Stereo separation	-60dB	very good
Distortion	1.9%	poor
Noise	-55dB	very good
Speed variation	0.03%	very good
Modulation noise	-40dB	good
Flutter energy (band level)	-25dB	good
MOL, ferric, 315Hz/10kHz	+4.0dB/-10.0dB	average
MOL, chrome, 315Hz/10kHz	+0.5dB/-10.0dB	average
MOL, metal, 315Hz/10kHz	+2.5dB/-2.0dB	very poor

Input/output performance

Line in (sensitivity/overload)	50mV/>3V
Mic input (sensitivity/overload)	200mV/00
Output	450mV
Typical price inc VAT	£229

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RECOMMENDED

SONY TC-R502ES

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TEL: STAINES 61688



The TC-R502ES is an interesting attempt to produce an 'audiophile' auto-reverse cassette deck. It is stoutly built and very well finished, using the now-obligatory satin black, with clear white symbols and legends. Supplementary descriptions such as 'laseramorphous head' and 'DC servo controlled motor' are in an old-gold finish which limits their visual intrusiveness.

A wide range of interesting features include quick auto-reverse, which uses optical sensing to eliminate the silence introduced by playing over a cassette's clear leader tape; optional blank auto-skip jumps past the long silences that occur at the end of pre-recorded tapes (operating after any ten second blank period).

A large, blue fluorescent display panel carries record level indicators and the tape counter. The latter shows approximate elapsed time and automatically blinks during recording when a tape is about to end — a useful feature. The record level indicators have a long scale with excellent range and resolution. They also double as calibration meters for record sensitivity adjustment, balancing out tape sensitivity error to allow accurate Dolby operation. In addition to Dolby B and C noise reduction Dolby HX PRO has been fitted, which in theory raises the overload headroom of a recorder. In practice it sometimes

seems of little value, but not on the '502ES, which benefited significantly.

LAB REPORT

The DC controlled transport servo motor displayed good speed stability under test, obvious in the flutter spectrum analysis by the sharpness of the test tone 'spike' at right: this indicates low drift; there's also obvious lack of flutter, but a trace of capstan wow is visible in the 'shoulders' either side of the spike, measuring 0.07%. The same basic lack of drift and low wow was maintained in reverse, only flutter increasing slightly. This is clearly a very high performance transport.

Despite the inaccurate replay response of TC-K444ESII, the '502ES avoided this shortcoming.

The replay response graph is relatively flat right up to 18kHz — a fine performance which was marginally better in reverse! The replay amplifiers were nevertheless very quiet and free of hum, so pre-recorded tapes should sound good.

Sound quality of pre-recorded tapes and recordings will also benefit from the high quality laseramorphous head, which produced an excellent set of overload figures, doubtless aided by Dolby HX PRO. Bias was a bit low for metal tape, but gave a good set of flat frequency res-

ponses with blank tapes of all types.

SOUND QUALITY

Pre-recorded tapes sounded excellent. Bass was weighty and solid, there was plenty of transient attack, and a fine sense of clarity. Only some 'edginess' was noted, in comparison with top references.

The tight sense of tempo noticed with musicassettes extended to recordings too. Metal tape (TDK MA-X) sounded a bit bright, occasionally displaying 'piercing' treble, but otherwise, clarity remained good, even at high levels, though some 'edginess' was noted. Chrome (Sony UX PRO) also has 'thin' upper treble which sounded somewhat confused, but otherwise clarity was good. Piano displayed precise pitch but some slight fast 'shimmer' was detected — most likely capstan wow. Ferric tape (TDK AD-X) proved disappointingly bright and 'edgy', and a lower grade tape like BASF LH-EI fared well.

SUMMARY

The TC-R502ES has proved itself as an audiophile auto-reverse cassette deck. Easy to use and possessing an array of useful facilities, it turned out fine recordings and handled pre-recorded tapes impressively well. Few decks manage so well all-round.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 20Hz-18.0kHz very good
 Speed accuracy _____ +0.6% good
 Noise _____ -62dB good

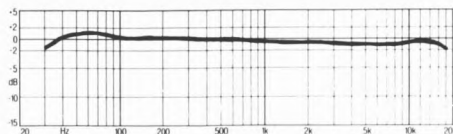
Record/replay using blank tape

Frequency response, ferric _____ 20Hz-17.0kHz very good
 Frequency response, chrome _____ 20Hz-17.0kHz very good
 Frequency response, metal _____ 20Hz-20.0kHz very good
 Stereo separation _____ -51dB good
 Distortion _____ -2.7% very poor
 Noise _____ -55dB very good
 Speed variation _____ 0.07% very good
 Modulation noise _____ -40dB good
 Flutter energy (band level) _____ -30dB very good
 MOL, ferric, 315Hz/10kHz _____ +4.5dB/-5.0dB very good
 MOL, chrome, 315Hz/10kHz _____ +1.0dB/-7.0dB good
 MOL, metal, 315Hz/10kHz _____ +2.5dB/+2.0dB poor

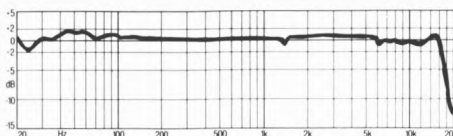
Input/output performance

Line in (sensitivity/overload) _____ 100mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 700mV
 Typical price inc VAT _____ £249

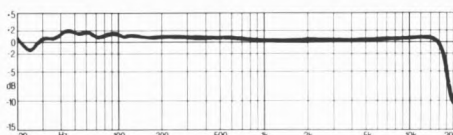
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



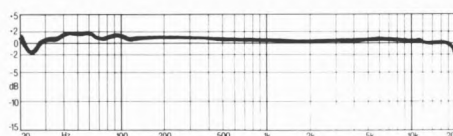
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

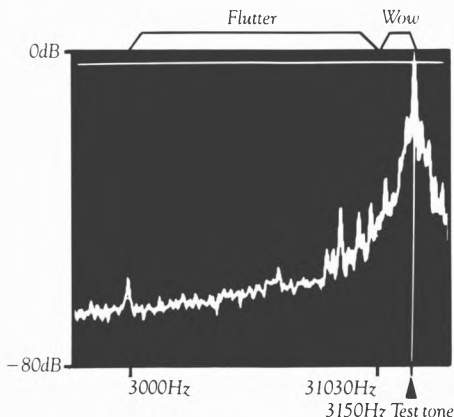


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



SONY TC-K444ESII

SONY (UK) LTD, SONY HOUSE, SOUTH STREET, STAINES, MIDDLESEX TW18 4PF.

TEL: STAINES 61688



Finished in the now statutory black, Sony's three-head, dual-capstan TC-K444ESII has the fine build quality expected of their mid-priced models, though the back-lit cassette holder lid is not flush with the casing, which looks a trifle odd. The logic transport operates smoothly and comes easily to hand. It responds quickly to unusual commands, jumping directly from fast forward to reverse without problems. Unusually for a logic controlled quality deck there was no 'punch-in' record mode, though the transport does include 'autoplay'.

Tape type selection is manual, which was an inconvenience, and neither tape selection nor MPX filter have status indicators, which can easily lead to recording errors. Dolby B and C facilities are push-button selected, the buttons being interdependent and backed by a bright warning display on the fluorescent display panel. Also on the panel are wide-range record level indicators and a tape counter with memory.

Sony fit both user-adjustable bias for tape tuning, and variable record-sensitivity to ensure accurate Dolby tracking, giving comprehensive tape matching options — at least with ferric and chrome tapes, if not metal.

LAB REPORT

Like so many other Japanese cassette deck

manufacturers, most Sony decks exhibit falling treble in their replay response, and the TC-K444ESII was a further example. The replay response graph clearly shows this state of affairs with a -6dB drop in output at 10kHz, and a second sample had an identical characteristic.

However, weaknesses related to the replaying of pre-recorded cassettes, made on other machines, do not necessarily manifest themselves in the quality of recordings that can be produced.

Independent record and replay heads do much to provide the flat frequency response of recordings made on ferric, chrome and metal tapes, the graphs showing this most clearly with metal tape. Obviously, ferric tape (IEC I Primary Reference Standard) is not flat, but reducing bias with the front panel control cured this.

Tests with a variety of awkward tapes showed there was enough bias adjustment range to cope with even the most awkward, like BASF CR-MII (chrome) and LH-XI (ferric), but unfortunately it does not affect metal bias. However, Sony have adjusted the machine very well for the IEC IV Primary Reference Standard, so it will match a majority of metals accurately — if not, ironically, Sony's own metal FS, which has a strong treble peak. The '444 got strong signals onto tape across the midrange. The bias/EQ balance favours this, but compromises

treble overload, which proved poor.

SOUND QUALITY

The dual capstan transport proved extremely good. It had negligible drift and, therefore, wow. The flutter analysis also reveals how a good dual capstan deck can suppress flutter, to give a very clean sound, which the listening tests confirmed.

In practice the *TC-K444 ESII* gave excellent recording quality with ferric tape (TDK AD) after bias adjustment, some treble confusion and 'diffuseness' being audible at high levels. Much the same quality was heard with chrome (TDK SA-X), but with less 'graininess' and a better sense of clarity. With metal tape (TDK MA) there was slight 'glassiness' in the treble, but otherwise an excellent sense of smoothness with no sign of the 'watery' pitch or 'warbling' tone heard on most of the other decks.

Needless to say, pre-recorded tapes sounded dull and muffled on this deck, and the sound stage was pinched into a central, bland-sounding morass. The '444 is not an ideal deck for replaying musicassettes.

SUMMARY

The *TC-K444 ESII* is a bit of a disappointment. Tape selection is manual which can lead to user error, and replay of musicassettes was poor. However, recording quality was excellent on all tape types, thanks to independent record and replay heads, married to a fine dual capstan transport.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-4.0kHz very poor
 Speed accuracy _____ +0.3% very good
 Noise _____ -63dB very good

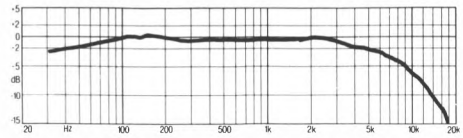
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-13.0kHz good
 Frequency response, chrome _____ 27Hz-20.0kHz very good
 Frequency response, metal _____ 27Hz-20.0kHz very good
 Stereo separation _____ -51dB good
 Distortion _____ 1.3% average
 Noise _____ -55dB very good
 Speed variation _____ 0.04% very good
 Modulation noise _____ -43dB very good
 Flutter energy (band level) _____ -34dB very good
 MOL, ferric, 315Hz/10kHz _____ +4.0dB/-10.0dB average
 MOL, chrome, 315Hz/10kHz _____ +1.0dB/-9.0dB average
 MOL, metal, 315Hz/10kHz _____ +4.0dB/-2.0dB very poor

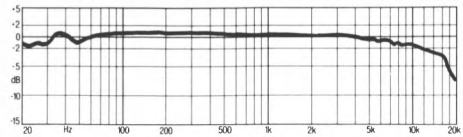
Input/output performance

Line in (sensitivity/overload) _____ 90mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 500mV
 Typical price inc VAT _____ £299

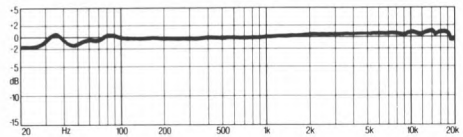
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



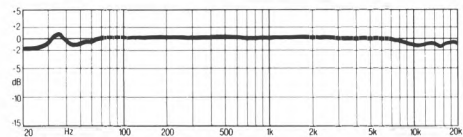
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

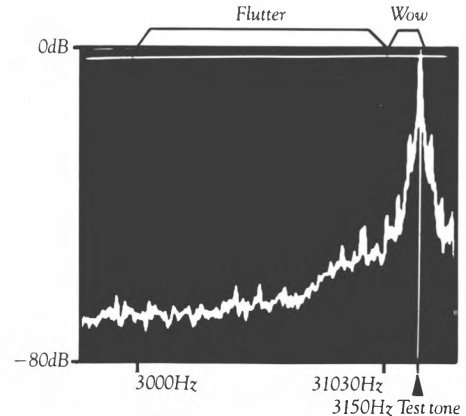


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



TANBERG TCD 3014A

TAN AUDIO (UK) LTD, PO BOX 31, CHICHESTER, WEST SUSSEX PO20 7RX.

TEL: (0243) 56342



Tandberg are a Norwegian company and tape decks are something of a speciality, the 3014A reflecting this in the scope and nature of its features. The heart of any good cassette deck is its transport system and this should be an effective dual capstan type. Tandberg's design uses four motors, one for each of the two tape hubs, one to drive the head platform into engagement with the cassette and one for both capstans. Tandberg discuss the problem of corresponding resonances producing cumulative speed instability in a dual capstan transport, so they too tune the rotating components to have dissimilar inertias ('mass differentiated' flywheels as they put it). However, the Tandberg transport uses belt drive from the capstan motor to the drive capstan, with a jockey belt from the flywheel to the back tension capstan. Direct drive to the main capstan at least, is more common these days. Analysis revealed more drift and low rate wow, especially at 5Hz, than expected, but very little flutter.

Confirmation of this company's dedication to

producing a no-compromise design is found in their use of entirely independent record and replay heads. The drawback is that either the record or the replay head has to be made adjustable to counteract cassette-generated azimuth error. Otherwise, cassettes would sound different when turned over or between samples.

This is made clear in Tandberg's operating manual: 'Azimuth adjustment should always be carried out before you start a recording, when you turn the cassette over or when you change to another cassette'. Since the record head is made adjustable, these observations only apply to recording, not to playing musicassettes, because the replay head is fixed.

Tandberg fit a mechanically linked azimuth adjustment knob just to the left of the cassette holder. They also provide a test system that provides a 15kHz tone. The idea is to tune for maximum signal, as indicated by the record level meters. In practice it wasn't as easy to use or so critical as some other approaches, but did prove effective all the same.

The main benefit totally independent heads have over siamesed types is that they are not

performance limited by size. This allows very high recording levels to be achieved, especially at low frequencies, by minimising core saturation. It also helps to keep bass response flat, since contour effects are more easily dealt with, and furthermore eliminates cross-feed at high frequencies, which can foul up Dolby operation when monitoring during the record process.

The benefits are most obvious with metal tape, where the TCD-3014 can achieve +5.5dB above the IEC reference flux using the IEC IV Primary Reference Standard tape. Few decks can match this — and higher figures can be achieved with good commercial tapes like Sony ES and TDK MA. It is not achieved at the expense of curtailed treble overload margins either, by using over-strong bias, saturation being -1.5dB with IEC IV, which is again a good result. Together with lowish hiss and virtually no hum, the 3014A provides more dynamic range than usual, especially from metal tape, solely because of its independent heads.

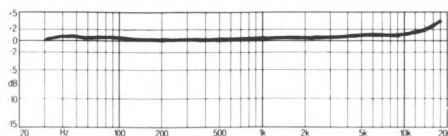
Tandberg choose not to modulate bias with Dolby HX Pro in order to gain overload headroom. Instead they have what they term 'Dyneq', which isn't the same as HX Pro at all in fact. What it does is prevent treble overload by dynamically reducing high frequency record equalisation in the presence of strong treble signals. As an overload prevention device, it minimises distortion rather than overcoming saturation.

Continued over page

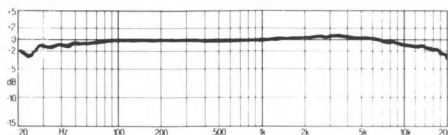
TEST RESULTS

Replay of pre-recorded musicassettes	
Frequency response	26Hz-15.0kHz
Speed accuracy	+0.0% (no error)
Noise	-60dB
Record/replay using blank tape	
Frequency response, ferric	26Hz-20.0kHz
Frequency response, chrome	26Hz-17.0kHz
Frequency response, metal	20Hz-20.0kHz
Stereo separation	-54dB
Distortion	0.6%
Noise	-51.5dB
Speed variation	0.08%
Modulation noise	-44dB
Flutter energy (band level)	-33dB
MOL, ferric, 315Hz/10kHz	+4.0dB/-5.5dB
MOL, chrome, 315Hz/10kHz	+1.5dB/-7.0dB
MOL, metal, 315Hz/10kHz	+5.5dB/-1.5dB
Input/output performance	
Line in (sensitivity/overload)	100mV/>3V
Mic input (sensitivity/overload)	None
Output	variable, 720mV max.
Typical price inc VAT	£1264

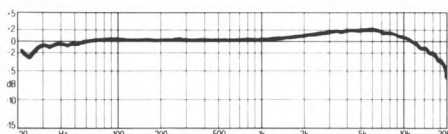
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



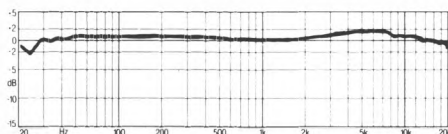
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

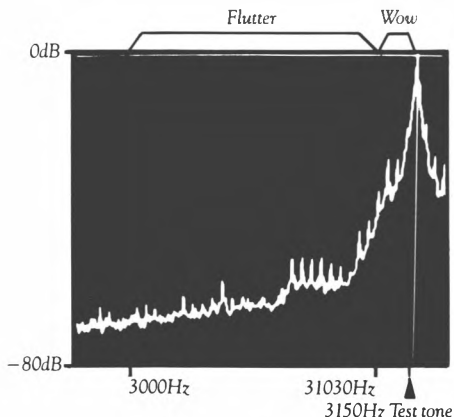


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



TANDBERG TCD 3014A

Continued from previous page

In appearance the 3014A is functional, if not beautiful. Large, round, spun-aluminium buttons are easy to press and have a light operating action. All commands go *via* logic circuits to operating relays, solenoids and a motor driven head platform, this allowing remote control, available as an extra.

I liked the open cassette tray, which speeds up loading and viewing. However, this deck is a bit curious in that it locks the cassette into place, necessitating a separate 'release' action before it can be removed. Fast winding proved very fast, like the old TCD-310.

Operation of the basic transport proved slick, but some of the controls felt a bit coarse by modern standards — and this does apply to the method of tape tuning provided. A special screwdriver is supplied for bias and record gain (sensitivity) adjustment. Inevitably, it has to be poked into holes on the fascia and jiggled around until it engages a potentiometer lurking beneath. There was too much adjustment range, even with metal tapes, making the adjustment action coarse. Using 315Hz and 15kHz test tones from an internal generator, performance is trimmed independently on each channel using the record level meters as indicators. They have limited resolution, so end results are a bit variable, and lab measurement revealed that frequency response above 10kHz often deviated from flatness by a few dB or so after adjustment.

This was especially the case with Type II tapes (chromes and pseudo-chromes). Record equalisation didn't suit them very well, as a 5kHz hump in the IEC II response showed. But IEC I (ferric tape) and IEC IV (metal) clearly demon-

strated how the independent record and replay heads successfully gave flat bass response and strong treble output up to 20kHz.

SOUND QUALITY

The replay-only frequency response, which affects musicassettes, was unusual in rising steadily above 1kHz, reaching no less than +3.5dB at 18kHz. This is almost certainly the prime cause of the bright sound I heard when playing musicassettes. Making a cassette deck sound over-bright is a dangerous thing to do, because good modern musicassettes have plenty of treble. The rising response degrades replay hiss by a few dB as well.

Recordings with metal tape (new TDK MA and Maxell MX) remained clean and unmuddled at very high recording levels, so hiss was little problem, especially with Dolby B or C in action. The flat, extended frequency response characteristic was reflected in the lack of tonal coloration. There was, however, some slight coarseness at times, and both wow and drift added a certain amount of pitch unsteadiness to critical programme, such as piano. But generally the TCD-3014A provided a high standard of recording quality on all three tape types and proved flexible enough to match all tapes available.

SUMMARY

Tandberg have put a concerted effort into the 3014A to wring the highest standard of performance possible out of cassette, irrespective of what complications this might involve. Their machine isn't the easiest to understand or use, but it is a very dedicated product of high performance.



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RECOMMENDED

TEAC V-343

HARMAN (AUDIO) UK LTD, MILL STREET, SLOUGH, BERKS, SL2 5DD.

TEL: (0753 76911)



The V-343 avoids much of the visual complexity of Teac's more expensive machines, but it is starkly simple even as budget decks go, and not without problems. Tape selection is manual, *via* interactive combination buttons which were an annoyance: it was difficult to determine their position and there was no status display, both factors promoting user error. Noise reduction is Dolby B only, again with no display, and the opportunity for operator error is further increased through one-touch record.

On the plus side, the 343's mechanical transport responds easily (if noisily) to a variety of commands including entering record from reverse or cue, a capability which perhaps makes up for the machine's audible motor noise. The peak level LED meter has a reasonable range but poor resolution. Record levels are set on a split level slider which proved awkward to use.

Styling was basically good, though the superfluous legends spread over the fascia cause initial confusion. Colourless symbols punched into the metallic faces were the only means of identifying the transport control buttons, so they were difficult to distinguish in certain lighting conditions. Unlike many other budget decks,

the V-343 retains both 'phones and mike sockets.

LAB REPORT

In spite of its budget pricing, the 343 transport mechanics were no disgrace. Measured wow was a low 0.06% and the sharpness of the test tone spike at right in the flutter analysis illustrates low drift and wow. Some capstan-generated shoulders are also visible, but further analysis showed they were at a relatively low level. Pre-recorded tapes played at the right speed.

Having only Dolby B noise reduction, dynamic range becomes significant, but inevitably a low cost deck cannot also have the expensive head needed to attain this. Nevertheless, the 343 head managed reasonably well with ferric tapes, though it started to fade with chrome and metal as is often the case.

Metal tape always gives well defined treble, even on budget decks like the 343. However, it will sound a bit more hissy than, say, new TDK SA if the recording level is kept down to avoid overload distortion. A relatively low hiss level of -64.5dB was recorded with Dolby B and chrome tape (BASF CR-EII). Adjustment for blank tapes was accurate, as the recording responses confirmed. Frequency response with

pre-recorded tapes proved reasonable, but with some treble roll-off which will inevitably cause dullness.

SOUND QUALITY

At the recording levels recommended by Teac for metal tape, Maxwell MX sounded messy, high level treble was diffused, and clarity and depth were mediocre. Tonal balance, however, sounded natural enough. On chrome tape (TDK SA), strings and horns had a coarse edge, while piano pitch was slightly 'watery' but otherwise stable. Transients were relatively fast, and in a chrome context definition was generally well maintained. Ferric had a messy, 'wiry' quality at high levels, and problems such as flutter and distortion were emphasized by treble lift. The result was mediocre even by budget standards.

Possibly due to head overload distortion, musicassettes sounded coarse at high levels, against which insight and transient behaviour were reasonable — in fact the 343 had greater insight and less softness and congestion than normally encountered.

SUMMARY

Although styling has been kept within reasonable limits, ergonomics are let down by some important omissions which could lead to operator error. However, performance, save with ferric, was reasonable by budget standards, even from musicassettes.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-11.0kHz good
 Speed accuracy _____ +0.6% good
 Noise _____ -62dB good

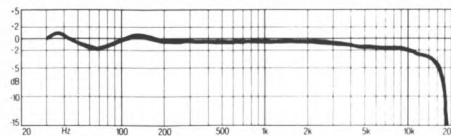
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-15.0kHz very good
 Frequency response, chrome _____ 27Hz-15.5kHz very good
 Frequency response, metal _____ 27Hz-16.5kHz very good
 Stereo separation _____ -44dB poor
 Distortion _____ 2.4% very poor
 Noise _____ -54dB very good
 Speed variation _____ 0.08% very good
 Modulation noise _____ -39dB average
 Flutter energy (band level) _____ -24dB average
 MOL, ferric, 315Hz/10kHz _____ +3.5dB/-8.5dB average
 MOL, chrome, 315Hz/10kHz _____ +0.5dB/-8.0dB poor
 MOL, metal, 315Hz/10kHz _____ +1.5dB/+0.0dB very poor

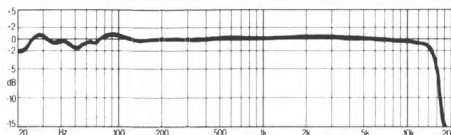
Input/output performance

Line in (sensitivity/overload) _____ 90mV/>3V
 Mic input (sensitivity/overload) _____ 0.4mV/28mV
 Output _____ 600mV
 Typical price inc VAT _____ £99

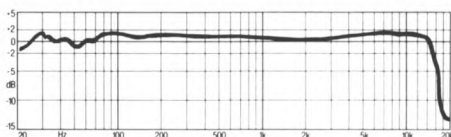
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



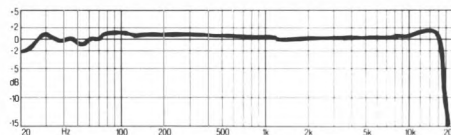
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

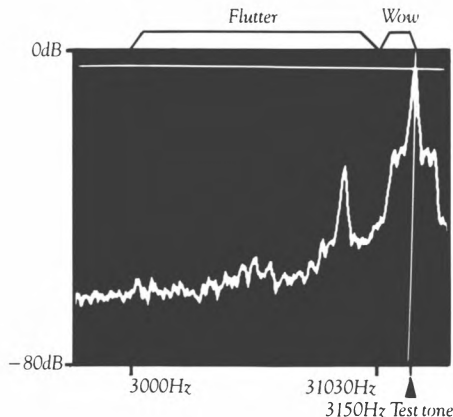


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



RECOMMENDED

TEAC R-505

HARMAN (AUDIO) LTD, MILL STREET, SLOUGH, BERKS SL2 5DD.

TEL: (0753) 76911



The auto-reverse *R-505* continues Teac's tradition for poor styling — there aren't enough features to write up a complete wallpaper of legends across the front panel, but the auto-reverse is advertised no less than three times! The random variety of dull colours and different typefaces make the *R-505* look messy, yet the transport controls are identified only by symbols. Being reasonably large and well placed they were easy enough to use, but there were strong clanking sounds in response to a reverse command, so the 'real time reverse,' 'super acculign rotating head,' 'two motor IC logic transport control' with 'bi-directional record/play' and 'super ARHS' may help to build confidence.

By using a rotating head (as nearly all auto-reverse decks now do) the deck will reverse-record, but tapes run right through to their end before reversal occurs, introducing a break and silence between sides. Record level is shown on a bright blue fluorescent display panel with quite good range and resolution. Automatic tape-type selection is another plus point, with bright status legends in confirmation. Dolby B and C noise reduction systems again have illuminated warning legends. Record level is set with twin parallel slider controls that wobbled somewhat.

Both microphone inputs and a headphones output are included, the former now something of a rarity.

LAB REPORT

Amongst various problems which can afflict auto-reverse is azimuth error, but happily the *R-505* did not exhibit any signs of this. It is also one of the only decks tested over the last three editions to show rising treble output with pre-recorded tapes, the replay response graph showing +2dB output at 10kHz, in both directions. This is decidedly odd, since the other Teac decks tested for this issue have a more common falling treble output. So one can be certain that the *R-505* will sound quite different with pre-recorded tapes.

Adjustment of recording frequency response with blank tapes was accurate, except for chrome which displayed excessive treble and will sound bright. Teac have used a good head, but low bias, so midrange overload (MOL 315Hz) was good and treble overload (SAT 10kHz) exceptional. However this brought about a bizarre imbalance with metal tape, +3dB SAT being higher than +2dB MOL. Noise figures look worse than usual, but in fact only reflect strong treble EQ in the replay amps. Speed stability proved fine in all respects, in both directions of play.

SOUND QUALITY

The rising treble replay response was immediately obvious with musicassettes. Mid-range emphasis pushed vocals forward, giving a very interesting sound with plenty of insight. Despite weak bass and poor dynamics the sound was quite unique, and the degree of insight captivating. The 505 doesn't have the bass presence of a Nakamichi, but was a 100% improvement on nearly all other decks.

Metal (Maxell MX) sounded warm and 'enclosed,' if a trifle 'wiry' on strings, but the sound was generally very smooth, stable and inoffensive, even at high levels. Pitch didn't waver on Chrome (BASF CR-E11) and there was no sign of 'drunkenness.' Indeed, the performance was solid and open. The accentuated treble gave a 'thin' sound at high levels, but remained clean and lacking distortion. Ferric (TDK AD) gave a fine sense of insight and excellent clarity, with upper treble only mildly 'thinned'.

SUMMARY

The 'job lot' appearance of this auto-reverse machine belied an impressive performance. Musicassettes sounded unusually striking, and the 505 also gave impressive recordings on metal and ferric tapes. Indeed, apart from the styling it proved an excellent all-rounder.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-10.0kHz good
 Speed accuracy _____ +1.3% poor
 Noise _____ -59dB average

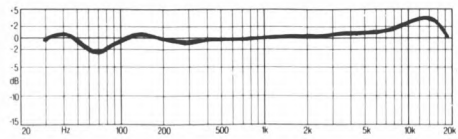
Record/replay using blank tape

Frequency response, ferric _____ 40Hz-16.0kHz very good
 Frequency response, chrome _____ 40Hz-7.0kHz poor
 Frequency response, metal _____ 40Hz-16.5kHz very good
 Stereo separation _____ -51dB good
 Distortion _____ -1.3% average
 Noise _____ -52dB average
 Speed variation _____ 0.06% very good
 Modulation noise _____ -38dB poor
 Flutter energy (band level) _____ -27B good
 MOL, ferric, 315Hz/10kHz _____ +4.5dB/-5.0dB very good
 MOL, chrome, 315Hz/10kHz _____ +0.0dB/-5.0dB average
 MOL, metal, 315Hz/10kHz _____ +2.0dB/+3.0dB poor

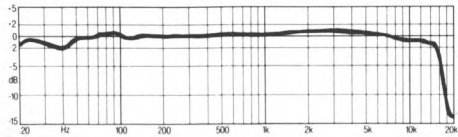
Input/output performance

Line in sensitivity/overload _____ 90mV/>3V
 Mic input sensitivity/overload _____ 0.7mV/25mV
 Output level _____ 450mV
 Typical price inc VAT _____ £199

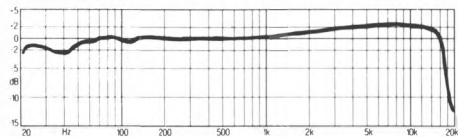
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



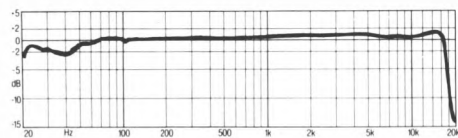
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

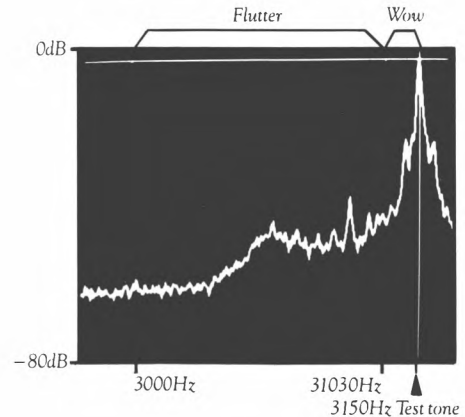


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



TEAC V 550X

HARMAN (AUDIO) UK LTD, MILL STREET, SLOUGH, BERKS SL2 5DD.

TEL: (0753) 76911



Big and beefy, Teac's two-head V550X packs a variety of facilities in a style which is all its own. The logic transport controls work smoothly enough, with only mild clanking. Unusual commands such as fast forward from reverse are accepted easily, but not 'punch-in' record. Tape selection is automatic and clearly displayed. Noise reduction systems include dbx in addition to Dolby, switched by interactive combination buttons whose confusion is somewhat overcome by a clear warning display.

Styling is a little unorthodox, and the legends on and around the touch panel facilities are in grey, blue and gold, which makes for visual confusion. The touch panels themselves need some pressure before activation and though the facilities they control are useful, they are also unnecessarily complicated to operate. These include block repeat, random programming allowing pre-selection of tracks, and 'intro check' which locates and plays the first fifteen seconds of each track.

The peak level meter display is fluorescent white and red, with a good -20 to $+12$ range and reasonable resolution. Recorded level is controlled through a poor two part slider. There are jacks for phones and mikes and a separate volume control for the phones.

LAB REPORT

More hiss reduction is offered with dbx than with Dolby C, but it does affect low level recordings of single vocalists or instruments, adding a 'pumping' or 'swishing' effect absent with Dolby. However, its headroom companding minimises overload distortion, making dbx well suited to high level rock music.

Hiss in the replay amps was very low, but a 150Hz hum component could be heard on low level piano recordings. Spectrum analysis showed that the audible component was about $+10$ db stronger than usual on tapes with poor hum screening, which includes both pre-recorded tapes and budget blank tapes. The hum wasn't generally noticeable behind music, but could be heard and proved an annoyance between tracks.

The single capstan transport mechanism showed very little speed drift and we noticed that piano notes sounded stable. The spectrum analyser warned of capstan wow at 7Hz, and sure enough there was just a slightly 'wiry' quality to sustained piano notes, best described as pitch impurity. The analysis shows reasonable freedom from flutter.

Teac have fitted a good head that enabled quite high tape signal levels to be achieved. The $+4$ dB MOL figure with metal tape is respect-

able, though the bias has been cranked up a bit to get these figures, so treble overload is a dB or so poorer than usual.

The recording frequency responses shown are all impressively flat at centre bias, which is a fine result, and the bias adjustment range was sufficient to flatten the response of awkward ferric and chrome tapes, including BASF CR-MII, the most deviant of all. As is often the case, bias adjustment didn't work with metal tape, which is a pity.

SOUND QUALITY

Listening tests showed that the Teac could provide well balanced and clean sounding recordings with ferric, chrome and metal tapes. There was a good sense of dynamism with metal in particular.

However, pre-recorded tapes sounded 'clothly' and a bit soft and dull. There was not the degree of congestion and smearing exhibited by other decks, but reproduction was hardly impressive either.

SUMMARY

Teac seem to have muddled through with the V550X. Its styling is unusual, even somewhat downmarket, with the look and feel of a budget deck, boosted by some of the facilities of more expensive machines. Beneath the surface performance is reasonable, providing clean recordings on all tape types, metal in particular. But like other decks from both ends of the market, replay-only performance left a lot to be desired.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-13.0kHz good
 Speed accuracy _____ +0.5 good
 Noise _____ -61dB good

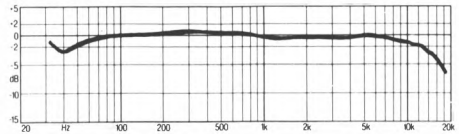
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-16.0kHz very good
 Frequency response, chrome _____ 27Hz-13.5kHz good
 Frequency response, metal _____ 27Hz-17.0kHz very good
 Stereo separation _____ -50dB average
 Distortion _____ 0.9% good
 Noise _____ -54dB very good
 Speed variation _____ 0.07% very good
 Modulation noise _____ -41dB good
 Flutter energy (band level) _____ -27dB good
 MOL, ferric, 315Hz/10kHz _____ +4.5dB/-8.0dB good
 MOL, chrome, 315Hz/10kHz _____ +2.0dB/-10.0dB average
 MOL, metal, 315Hz/10kHz _____ +4.0dB/-1.0dB poor

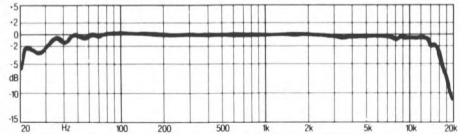
Input/output performance

Line in (sensitivity/overload) _____ 85mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 430mV
 Typical price inc VAT _____ £229

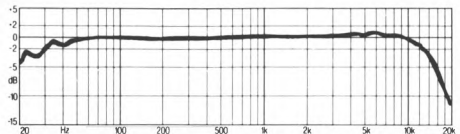
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



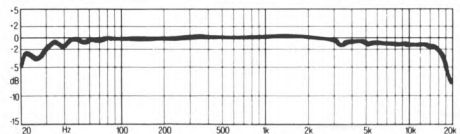
OVER ALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

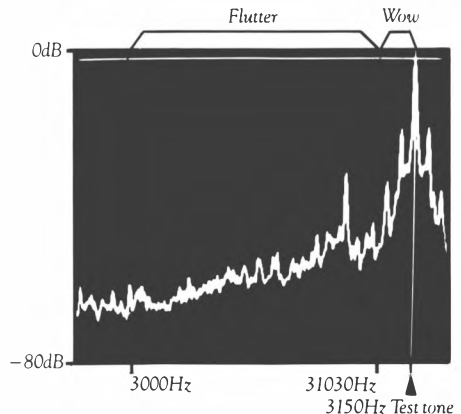


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



TECHNICS RS-B55

PANASONIC(UK)LTD, 300-318 BATH ROAD, SLOUGH, BERKS.

TEL: (0753) 34522



The RS-B55 is little larger or more imposing than the less expensive '405, but perhaps surprisingly it is no more complex either. Although it has dbx noise reduction as well as Dolby, the '55 does not have user adjustable bias (tape tuning). It is quite straightforward and consequently easy to operate.

One major contributor is the automatic tape type selection, which is always a boon, and is backed by clear, illuminated blue status legends. These are part of a fluorescent multi-colour display panel, which also includes record level indicators, a four digit tape counter, and a revolving symbol that shows clearly, from a distance whether the transport is working or not. 'Tape running' lights, as these used to be called, keep reappearing despite their doubtful value.

Logic control made operations comparatively straightforward, but the fast reeling buttons proved somewhat small and poorly identified. Many decks no longer have microphone sockets, but they are retained on this machine. Set just above, in a neat line are the noise reduction selector buttons, with an appropriate legend that lights on the display panel.

LAB REPORT

Technics decks have been well set up for stan-

dard hi-fi tapes, and the RS-B55 was no exception. The frequency response graphs with ferric, chrome and metal tape are all remarkably flat, showing good extension to frequency extremes. This will give recordings a subjectively even-sounding tonal balance on good hi-fi tapes like TDK AD and SA-X, aided by the accurate sensitivity adjustment needed to produce correct Dolby tracking.

However, replay frequency response was -2dB at 10kHz , subsequently falling to -9dB at 18kHz , which was due to azimuth misalignment and subsequently corrected. Nevertheless, head performance comes into the equation, and the amorphous head used proved good enough under test to suggest that pre-recorded tapes may not sound as muffled as is often the case.

In order to gain good midband distortion and MOL figures, bias has been cranked up, and this regrettably compromises treble overload — Dolby HX PRO would have kept treble overload margins up, and might have been considered on a machine of this price.

The transport maintained speed accurately, with little drift and not much wow. However, higher flutter than usual can be seen in the analysis (0.17%), and Mod noise was above average too, both factors affecting clarity.

SOUND QUALITY

Chrome tape (TDK SA) exhibited strengthened bass, giving the sound a lot of weight. There was some 'dimness' in the upper treble, removing treble 'sparkle', and a degree of 'coarseness' was heard the latter, almost certainly due to flutter. Metal tape (TDK MA-X) proved much more impressive than chrome, sounding tonally even, very well defined in its transient attack, and with strong bass. Some sibilance 'spitch' was occasionally obvious though — again a flutter problem. Piano possessed tonal purity and fair stability, but was not exactly pitch-tight. Ferric tape (TDK AD-X) again displayed some treble 'edginess' plus 'rich' bass.

Pre-recorded tapes confirmed that the transport was basically speed stable by their strong sense of temporal control and definition. There was no muddle in the sound, but some warmth was evident and little extreme treble. Nevertheless, overall clarity and dynamism were strong features, making for an exciting sound.

SUMMARY

Although expensive, the RS-B55 has little to offer in the way of special facilities, being a relatively simple but easy-to-use recorder. Sound quality reached a respectable standard with all tape types, metal tape being most impressive. Pre-recorded tapes played extremely well, so overall performance was very good, though not exceptional.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 35Hz-10.0kHz good
 Speed accuracy _____ +0.8% good
 Noise _____ -60dB good

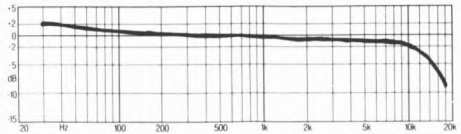
Record/replay using blank tape

Frequency response, ferric _____ 22Hz-14.0kHz good
 Frequency response, chrome _____ 21Hz-16.0kHz very good
 Frequency response, metal _____ 21Hz-18.0kHz very good
 Stereo separation _____ -51dB good
 Distortion _____ 1.9% poor
 Noise _____ -54dB very good
 Speed variation _____ 0.09% very good
 Modulation noise _____ -37dB poor
 Flutter energy (band level) _____ -27dB good
 MOL, ferric, 315Hz/10kHz _____ +4.0dB/-12.0dB poor
 MOL, chrome, 315Hz/10kHz _____ +1.0dB/-9.0dB average
 MOL, metal, 315Hz/10kHz _____ +4.0dB/-0.5dB poor

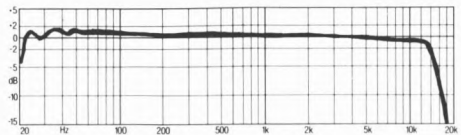
Input/output performance

Line in (sensitivity/overload) _____ 80mV/>3V
 Mic input (sensitivity/overload) _____ 0.34mV/27mV
 Output _____ 400mV
 Typical price inc VAT _____ £200

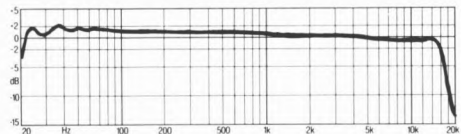
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



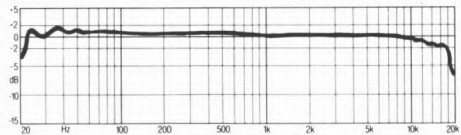
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

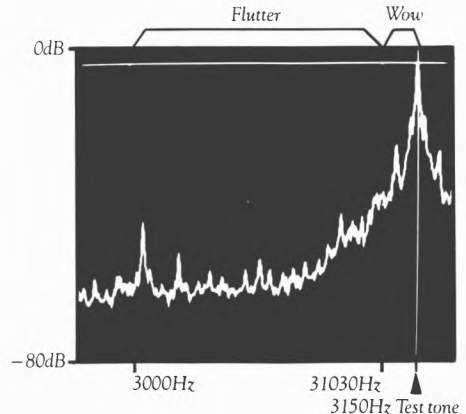


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



BEST BUY

TECHNICS RS-B305

PANASONIC (UK) LTD, 300-318 BATH ROAD, SLOUGH, BERKS SL1 6JB.

TEL: (0753) 34522



The RS-B305 is a two-head machine finished in subdued, smokey grey. Simplicity of style is combined with good build quality — uncommon in a low cost deck. There was no confusion of lights and legends either. The transport control legends are matched with their symbols for clarity, although elsewhere the lettering varies erratically from bright white to dull grey. Bright yellow and red block LED peak level meter displays give greater clarity than usual, though the meter itself has a limited downward range. The feather-touch logic transport responded quickly and smoothly, accepting unusual commands such as fast reverse to cue without delay. The transport is a trifle noisy, as usual with budget decks. Record mode is activated by touching Record then Play, which largely eliminates the possibility of accidental recording. Surprisingly for a budget machine, 'punch-in' recording was handled easily, as was fast reverse from record mode.

Tape selection is by push buttons, but at least they were not inter-dependant. The Dolby buttons were mutually dependant and lack a display. The inclusion of a separate Record Balance facility avoids the fuzziness of dual rotary controls.

LAB REPORT

The replay frequency response has a problem,

as the graph shows, doubtless because it derives from Japanese test tapes which are insufficiently accurate 'transfer standards.' Neither hiss nor hum were a problem in the replay amps. Classical tapes with extended low level musical passages could be played at high volume without any sign of hum. Replay speed was tolerably accurate too, measuring 0.7% fast, and I was never aware of incorrect tempo.

The transport showed good speed stability, with exceptionally low drift and wow, plus acceptably low flutter. Doubtless the '305 test sample was particularly good, because machines at triple the price rarely do so well. But nevertheless that this level of performance should even be possible is a point in this deck's favour. It was most surprising to find the maximum recording level that could be squeezed onto tape, especially metals; at +4dB MOL with metal the '305 has a +2dB advantage over most rivals. This means that recording levels can be kept a little higher, making hiss less noticeable. The '305 is one of the few budget decks capable of getting as much midrange signal on to metal as it can on to ferric tape.

The unusually low distortion figure is due to this factor, plus use of a somewhat low indicated 0VU level. Recordings can be taken 'into the red' without fear of serious distortion. Factory alignment to international standards for

ferric, chrome and metal tapes was fine, as shown in the graphs.

SOUND QUALITY

Pre-recorded tapes sounded temporally 'tight' and well controlled as did recordings made on the machine, a direct consequence of the good speed stability. A critical piano recording demonstrated fine note 'solidity', with little sense of pitch 'wateriness'.

Whilst dullness was clearly audible when listening to pre-recorded tapes, the 305 still showed itself capable of providing a good sense of insight into music, keeping vocalists and instruments well separated. There was a strong sense of 'life' and dynamics.

We made some fine recordings on the 305, using all three tape types. Listening tests confirmed slight dullness with ferric, which was successfully neutralised by use of BASF LH-XI which has rising treble.

SUMMARY

We were suitably impressed by the 305's handling of musicassette, an ability noticeably absent from many more expensive machines. It made fine recordings too.

Simplicity of design makes the deck easy to use, and Technics have resisted the temptation to waste their efforts on unnecessary cosmetics. All in all, the RS-B305 provides excellent value for money.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-9.5kHz average
 Speed accuracy _____ +0.7% good
 Noise _____ -57dB poor

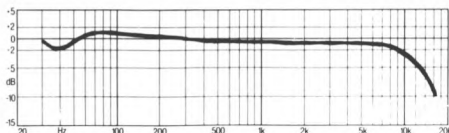
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-15.0kHz very good
 Frequency response, chrome _____ 27Hz-13.0kHz good
 Frequency response, metal _____ 27Hz-16.0kHz very good
 Stereo separation _____ -48dB average
 Distortion _____ 0.4% very good
 Noise _____ -53dB good
 Speed variation _____ 0.05% very good
 Modulation noise _____ -40dB good
 Flutter energy (band level) _____ -29dB good
 MOL, ferric, 315Hz/10kHz _____ +4.5dB/-7.0dB good
 MOL, chrome, 315Hz/10kHz _____ +2.0dB/-9.0dB average
 MOL, metal, 315Hz/10kHz _____ +4.0dB/+0.0dB average

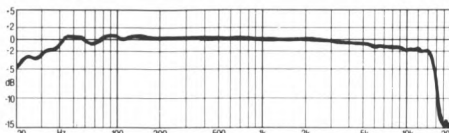
Input/output performance

Line in (sensitivity/overload) _____ 100mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 450mV
 Typical price inc VAT _____ £120

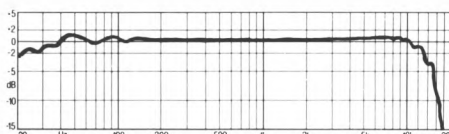
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



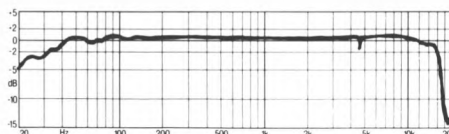
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

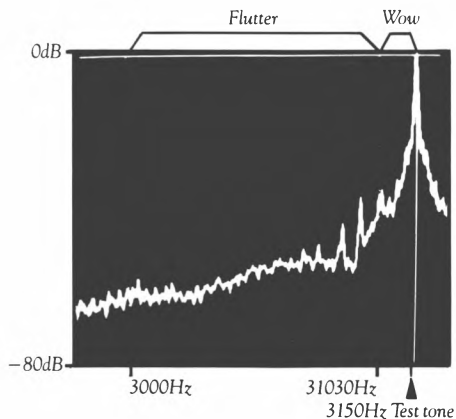


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



RECOMMENDED

TECHNICS RS-B405

PANASONIC(UK)LTD, 300-318 BATH ROAD, SLOUGH, BERKS SL1 6JB.

TEL: (0753) 34522



The '405 is a simple step up from the less expensive '305, the main difference being the addition of dbx noise reduction to Dolby B & C. Hiss is suppressed better by dbx than Dolby but it also adds a disconcerting 'swishing' sound to piano, and simple solo performance in general; the peak-companding helps avoid tape overload and is more suited to high level rock music than classical works with wide dynamic level changes. We find Dolby preferable, and used it in all listening tests.

A clear control layout and fine logic controlled transport made the '405 easy to use. Technics have not piled it high with spurious lights and facilities. Tape type selection is manual — about the only point to criticise.

LAB REPORT

Technics decks are measuring well in 1986. The '405 is a better '305 in all senses of the word, but reflects the '305 basic strengths all the same.

Accurate replay frequency response, at least to 10kHz, is one rare achievement Technics have now notched up. However, the steep roll-off in treble above 12kHz was disappointing. This was probably due to high frequency gain curtailment of replay EQ in order to lower hiss rather than azimuth error. Hiss figures weren't especially good in any case; other decks are 5dB or so

better. The speed stability of the transport mechanism was good, suffering little drift, wow or flutter, as shown in the spectrum analysis by the sharpness of the peak at right (low drift), the low level of 'shoulders' (wow), and 'rubbish' (flutter) to its left. Flutter band-energy in this analysis measured -32dB, which is low. Peak record level (0VU) has been set to Dolby flux as usual. Unfortunately, Technics' fluorescent record-level meters under-read by -6dB at 40Hz, so bass-heavy music could over-record by an equivalent amount on this machine. The head proved a good one. It allows high maximum signal levels to be recorded onto tape, although the bias had been set high to achieve this, at the expense of treble overload (saturation). Ferric and chrome tapes will have 'fluffy'-sounding high level treble as a result.

The frequency response graphs show that this machine was accurately set up for all tape types, achieving good results with standard hi-fi tapes like TDK AD, Maxell UD-II and TDK MA-X.

SOUND QUALITY

With ferric tape (TDK AD) the '405 displayed 'splasy'-sounding high level treble, but also good clarity, an even tonal balance, and a strong sense of definition. Chrome (BASF CR-EII) showed the absence of motor noise or hum and the fine speed stability, with just a degree of 'wateri-

ness' of pitch evident on critical piano works. There was some tonal 'warmth.' Metal tape (TDK MA-X) gave fine clarity and transient definition, and again a hint of tonal 'warmth.' Tight timing, due to fine speed stability, gave good definition.

With pre-recorded tapes the RS-B405 excelled — just like the '305. Still tonally 'warm', there was none of the murkiness and imprecision of many competitors. Music was strongly defined, dynamic and exciting.

SUMMARY

The RS-B405 is a straightforward cassette deck which lacks unnecessary facilities, but was well styled and easy to use. Its logic-controlled transport was a fine performer, contributing much to the fine tight timing displayed with pre-recorded tapes and recordings. Technicians have used top quality components, intelligent design and accurate alignment to achieve excellent all-round results with this machine.

TEST RESULTS

Replay of pre-recorded music cassettes

Frequency response _____ 30Hz-12.5kHz good
 Speed accuracy _____ +0.2% very good
 Noise _____ -57dB poor

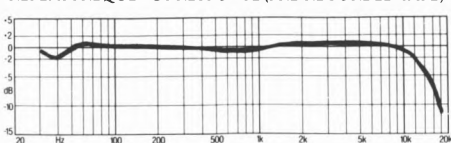
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-15.5kHz very good
 Frequency response, chrome _____ 27Hz-16.5kHz very good
 Frequency response, metal _____ 27Hz-18.0kHz very good
 Stereo separation _____ -46dB average
 Distortion _____ 2.4% very poor
 Noise _____ -53dB good
 Speed variation _____ 0.07% very good
 Modulation noise _____ -42dB good
 Flutter energy (band level) _____ -32dB very good
 MOL, ferric, 315Hz/10kHz _____ +4.0dB/-12.0dB poor
 MOL, chrome, 315Hz/10kHz _____ +1.3dB/-10.0dB average
 MOL, metal, 315Hz/10kHz _____ +4.0dB/-1.0dB poor

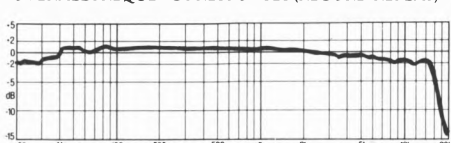
Input/output performance

Line in (sensitivity/overload) _____ 70mV/>3V
 Mic input (sensitivity/overload) _____ 0.3mV/25mV
 Output _____ 350mV
 Typical price inc VAT _____ £167

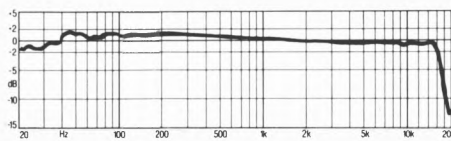
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



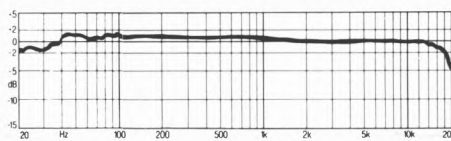
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

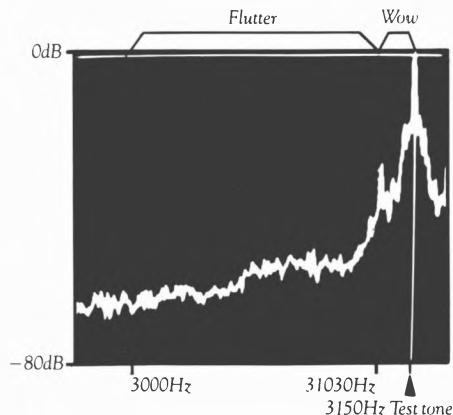


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



BEST BUY

TECHNICS RS-T80R

PANASONIC (UK) LTD, 300-318 BATH ROAD, SLOUGH, BERKS.

TEL: (0753) 34522



Technics' new found simplicity of style is continued in the RS-T80R double reverse dubbing deck. Facilities are situated in a group to the right of the deck, clearly marked and easy to use. The logic controlled transport is smooth and quiet, accepting most commands with ease, except 'punch-in' record. For clarity, both legends and symbols are used. The replay-only deck, identified as No1, and the record and replay deck (No2) both possess automatic tape switching which, as always, makes operation easier. Dolby and dbx noise reduction are fitted, as on most Technics decks: dbx offers more hiss reduction, but can cause 'swishing' sounds under certain circumstances.

A fluorescent white and red peak record-level meter has broad range and good resolution. Facilities include synchronised recording (both decks recording from the same source simultaneously); continuous play mode (where both sides of a tape can be played up to sixteen times); series recording or playback (plays the front side then the reverse side of both tapes in turn). In series record mode, the unused transport may be fast cued or reversed. Dubbing (called Edit recording on this machine) can be made with Tapes 1 and 2 travelling in opposite directions, though continuous recording is not possible in this mode. A headphone output is fitted.

LAB REPORT

The 1986 range of Technics cassette decks — or at least those tested in this book — have proved especially successful, and perusal of the test results for their RS-T80R clearly shows this improvement also applies to the dubbing deck range. These don't usually measure as well as their conventional cousins, but the RS-T80R actually measured better than many conventional decks. Both the auto-reverse transports exhibited almost perfectly flat replay responses from 40Hz up to 18kHz, reverse azimuth error in one causing treble loss of -2dB at 10kHz. Otherwise, loss at 10kHz did not exceed -1dB, in forward or reverse play. Musicassettes should therefore sound fairly clear.

An overall average distortion figure of 1% indicates that a quality head has been used, and this is confirmed by the healthy overload ceiling figures (MOLs and SATs). Moreover, Technics manage low hiss figures too, in spite of keeping replay response accurate. The speed stability spectrum analysis for the recording deck clearly shows low drift and wow by the sharpness of the main 'spike' (test tone) at right. Flutter is visible though, and indeed measured on the high side. Measured wow on the playback-only deck was a bit higher at 0.12%. Recording frequency responses measured very flat on ferric, chrome and metal IEC standard tapes.

SOUND QUALITY

Overall, the listening tests confirm the lab report. Musicassettes had good dynamic range with only minimal treble loss and compression, so maintaining the subjective 'punch'. With Maxell MX (metal), treble was slightly bright without being aggressive, and the fine sense of dynamic range and separation gave a smooth, clean sound without mess or muddle at high levels. Chopin *Nocturnes* had tight, clean, solid pitch on chrome (BASF CR-EII), with no indeterminacy. Tonal balance was smooth and clearly defined on TDK SA without any obvious symptoms of treble overload. Ferric (TDK-AD) had slightly bright treble and a broad subjective dynamic range. However, transient attack was restrained, and there was some sense of muddle.

Dubbing from metal to metal was mildly treble-heavy and compressed but not unpleasant. At high speed these characteristics were amplified, causing 'thinning' and lack of 'punch'.

SUMMARY

The RST80R combines simplicity of style, ease of operation, and excellent performance. The use of a good head, identified by lab tests, was confirmed by good sound quality with recordings on all tape types, and with musicassettes. Overall this is an excellent machine, even though it sells at a high price.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 35Hz-18.0kHz very good
 Speed accuracy _____ +0.7% good
 Noise _____ -60dB good

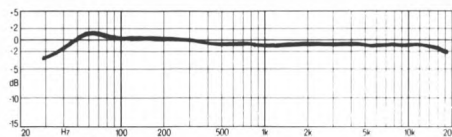
Record/replay using blank tape

Frequency response, ferric _____ 35Hz-16.0kHz very good
 Frequency response, chrome _____ 35Hz-17.0kHz very good
 Frequency response, metal _____ 30Hz-16.0kHz very good
 Stereo separation _____ -51dB good
 Distortion _____ 1.0% good
 Noise _____ -54dB very good
 Speed variation _____ 0.07% very good
 Modulation noise _____ -40dB good
 Flutter energy (band level) _____ -23dB average
 MOL, ferric, 315Hz/10kHz _____ +4.5dB/-10.0dB average
 MOL, chrome, 315Hz/10kHz _____ +0.0dB/-8.0dB average
 MOL, metal, 315Hz/10kHz _____ +2.5dB/-1.0dB poor

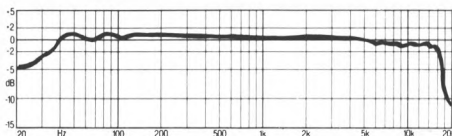
Input/output performance

Line in (sensitivity/overload) _____ 80mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 500mV
 Typical price inc VAT _____ £350

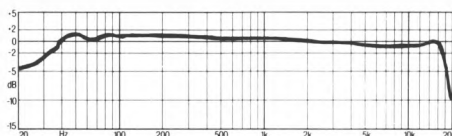
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



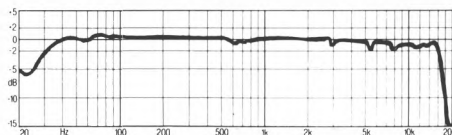
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

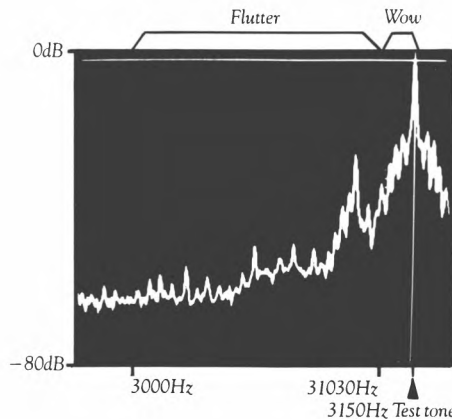


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



TRIO KX-54

TRIO (UK) LTD, 17 BRISTOL ROAD, THE METROPOLITAN CENTRE, GREENFORD, MIDDLESEX UB6 8UP.
TEL: 01-575 6030



Trio build this deck in a manner not now commonly seen with budget products, with a metal chassis and front panel which impart a good feeling of solidity, even though the transport controls tend to 'clang' as a result — how these can be described as 'soft touch,' I don't know. This budget design dispenses with all but the most basic facilities, though it does have Dolby B and C noise reduction systems, metal tape recording capability, and a simple but useful music search system.

Tape type selection is manual and there is a simple, unlit three-digit tape counter, without zero-stop. Two red LED displays indicate recording level, and tests showed they captured musical peaks well enough, sensing high and low frequency information accurately. Twin microphone inputs are fitted and the deck can be set to auto-start from an external timer for absent recording or play.

LAB REPORT

Substantial azimuth or replay equalisation error resulted in a falling treble replay characteristic. Output was -4dB down at 10kHz with Dolby B out, and since Dolby B only magnifies the error with musicassettes, the net result will be

a very dull, vague sound on pre-recorded tapes.

Replay noise was very low, but this seems likely to be due in part to inadequate high frequency gain in the replay amps. Replay speed ran 1% fast and stability proved very poor at 0.25% total wow and flutter (DIN-weighted). There was a lot of rapid speed drift, which resulted in substantial wow which will certainly be audible, even with musicassettes. Overall replay performance which determines fidelity on musicassettes was generally very poor by current budget-deck standards.

The speed drift problem of the transport was much the same in magnitude when recording, generating substantial levels of both wow and flutter. Flutter measured 0.3% and band-energy flutter level measured -23dB — a very high figure. This will destroy all sense of clarity. Because the transport couldn't stick to one speed, drifting by an amount five times greater than usual (0.5%), recordings will be pitch-indeterminate too.

Adjustment of frequency response for ferric and metal tapes was very good, although only metals with rising treble, such as TDK MA and Sony ES are perfectly compatible, to give a flat response and perfect Dolby tracking. Chrome tapes will sound a bit bright, since the machine

displayed +2dB treble lift, as the graph shows. Dolby will emphasise this.

The head gave good overload ceilings with ferric tape, but chrome tape was inexplicably poor in the midband and so was metal. Slightly low bias partly explains these figures, treble overload being better than usual, especially with metal tape, but I suspect metal bias might also be pushing the head into non-linearity too.

SOUND QUALITY

Subjectively, a 'jelly-like' wobbling of notes due to wow was obvious with all tape types. Piano notes were actually off-key, or 'cracked' with this deck. Tonal balance with TDK MA was good, though severe distortion due to overload occurred at high levels. Chrome tape (TDK SA) sounded bright, but not overpoweringly so. Muddling was again the result of overload distortion, and the pitch wobbling proved pervasive. Ferric tape gave an even tonal balance, a fairly soft presentation and less aggressive treble. Sound quality would have been good, except for the wow which made piano notes meander severely.

Musicassettes sounded dull and leaden in tone. There was no apparent upper treble, causing cymbals and fine detail to be suppressed. Pitch was again shaky. Strong bass was evident.

SUMMARY

The KX-54 is a substantially built budget cassette deck, shorn of facilities to keep price down. Trio have included Dolby B and C noise reduction systems though, plus a simple but useful music search facility. Tape type selection is manual, using large square press-buttons. Performance with musicassettes was poor even as budget decks go. Their sound was dull and lifeless. Severe wow affected recordings, making everything vary in pitch erratically. This problem blighted the deck.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response	281Hz-7.0k1Hz	poor
Speed accuracy	+1.0%	average
Noise	-61dB	good

Record/replay using blank tape

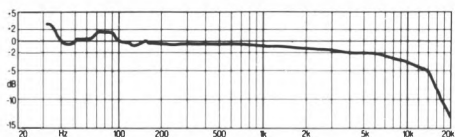
Frequency response, ferric	221Hz-16.0k1Hz	very good
Frequency response, chrome	221Hz-16.0k1Hz	very good
Frequency response, metal	22Hz-16.0k1Hz	very good
Stereo separation	-47B	average
Distortion	1.1%	average
Noise	-53dB	good
Speed variation	0.25%	very poor
Modulation noise	-35dB	very poor
Flutter energy (band level)	-23dB	average
MOL, ferric, 3151Hz/10k1Hz	+3.5dB/-7.0dB	good
MOL, chrome, 3151Hz/10k1Hz	-2.5dB/-7.0dB	very poor
MOL, metal, 3151Hz/10k1Hz	+1.5dB/+0.5dB	very poor

Input/output performance

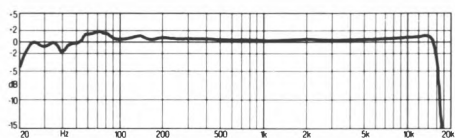
Line in (sensitivity/overload)	70mV/>3V
Mic input (sensitivity/overload)	1mV/90mV
Output	300mV
Typical price inc VAT	£99

REASSESSED

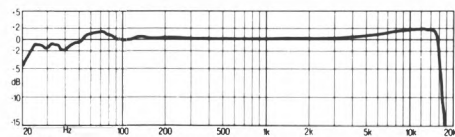
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



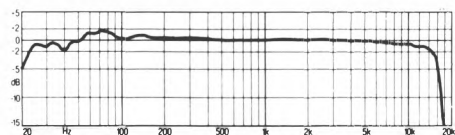
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

TRIO KX-74

TRIO(UK)LTD, 17 BRISTOL ROAD, THE METROPOLITAN CENTRE, GREENFORD, MIDDLESEX UB6 8UP.
TEL: 01-575 6030



This reasonably gadget-free auto-reverse deck is housed in a robust metal case, though internal inspection showed much the same sort of build as usual. The front panel creates a favourable impression with well-located push buttons and switches which don't wobble when pressed. The transport is logic controlled and the control buttons were easy to identify and use, because the uncluttered front panel didn't distract the eye from their associated legends. 'Punch-in' recording was not possible, but most other commands were, like going direct to fast rewind from recording.

Although reverse recording is provided, this is not a 'fast reverse' deck, so the leader tapes will cause a gap of about 10 seconds when making an unattended recording on both sides of a cassette, or when playing pre-recorded cassettes. Looking into the cassette compartment showed that fittings for optical sensors existed, but the crucial parts were not fitted.

Trio fit a simple but easily used music search system, and incorporate both Dolby B and C noise reduction systems, plus the considerable convenience of automatic tape-type selection.

LAB REPORT

Measuring frequency response of recordings revealed a problem straight away. Ferric tape (IEC -I) has falling treble above 5kHz, which will make it sound very dull. Even the tape with highest treble sensitivity, Maxell *XL-IS*, could not compensate for this response error. Dolby will emphasise the problem, resulting in an extremely dull sound. Chrome was better, but still had falling upper treble.

Since ferric, chrome and metal midband overload figures (315Hz MOLs) were all high and treble overloads (10kHz saturations) low, over-bias was the problem. Looking inside revealed the usual single pair (left and right) of bias-adjust potentiometers. This means that relative bias levels for the different tape types are linked, which allows the machine to be factory-set on tape alone (usually metal) to save time. Predictably, metal tape gave a flat response, but the others did not. (Complicating the issue, metal record equalisation was found to be wrong, but I can't go into this here.) Suffice to say, the designers have apparently got relative bias levels and the bias/record equalisation balance wrong on this machine meaning that if one tape gives

correct results the others automatically won't.

Transport speed stability was respectable in both directions, when recording and when replaying. Some regular capstan wow was heard and measured (6Hz rate), plus a flutter peak at just -25dB 40Hz either side of a test tone. This sort of thing adds 'muck' and 'coarseness' to programme, like distortion.

Replay frequency response was fairly flat up to 10kHz in both directions of play, and Dolby B tracking was good as a result. Higher frequencies fell away. replay hiss and hum were low, but replay speed was a bit fast in both directions. Track alignment proved good.

SOUND QUALITY

Metal tape (Memorex *Metal IV*) displayed good clarity and even tonal balance, which we liked. There was slight grittiness from flutter, most noticeable on vocals. Chrome tape (TDK *SA*) sounded smooth and distortion free; we felt that falling extreme treble helped towards this, but also conspired with saturation to dull and compress transients from cymbals and high-hat in particular. Wow was present as a 'diluting' quality, or 'slurring.' Ferric tape (TDK *AD*) sounded muffled and 'woolly.' Saturation muted transients.

Musicassettes sounded slightly dull but stereo imaging was acceptable. The speed error was noticeable against our *Dragon* reference, as was some flutter on critical programme.

SUMMARY

A straightforward auto-reverse deck, the *KX-74* offers reverse recording, but not optical leader tape sensing for 'fast reverse.' It has the valuable convenience of automatic tape type selection and a simple front panel layout that made pressing the right button easy. Replay performance was quite good in both forward and reverse directions. Recordings on ferric tape were unacceptably dull, but chrome and metal gave reasonably good results. Overall, we felt that the *KX-74* could easily have been better, but performance was judged acceptable all the same.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response	28Hz-14.0kHz	good
Speed accuracy	+1.3%	poor
Noise	-60dB	good

Record/replay using blank tape

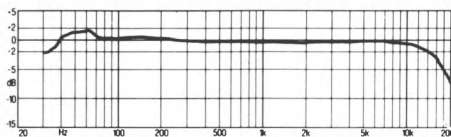
Frequency response, ferric	28Hz-8.0kHz	average
Frequency response, chrome	28Hz-16.0kHz	very good
Frequency response, metal	28Hz-18.0kHz	very good
Stereo separation	-47dB	average
Distortion	0.5%	very good
Noise	-53dB	good
Speed variation	0.10%	good
Modulation noise	-32dB	very poor
Flutter energy (band level)	-28dB	good
MOL, ferric, 315Hz/10kHz	+3.5dB/-10.0dB	average
MOL, chrome, 315Hz/10kHz	+0.5dB/-9.5dB	average
MOL, metal, 315Hz/10kHz	+4.0dB/-2.5dB	very poor

Input/output performance

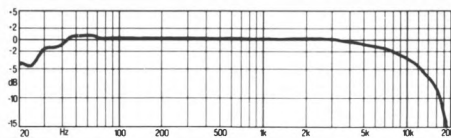
Line in (sensitivity/overload)	60mV/>3V
Mic input (sensitivity/overload)	None
Output	300mV
Typical price inc VAT	£139

REASSESSED

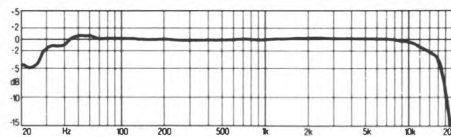
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



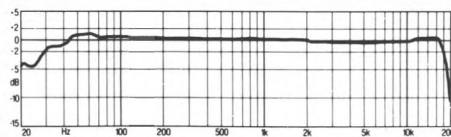
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

TRIO KX-780

TRIO (UK) LTD, 17 BRISTOL ROAD, THE METROPOLITAN CENTRE, GREENFORD MIDDLESEX UB6 8UP.
TEL: 01-575 6030



Trio's *KX-780* has a conventional single-capstan, unidirectional transport, but is fitted with independent (siamesed) record and replay heads to provide off-tape monitoring. 'Music search' as such is not included. Instead, the *KX-780* has a somewhat confusing skipping arrangement which enables fixed lengths of tape to be jumped. Because this procedure resets the counter, any previously set 000 position is lost. The transport is logic controlled, but it is not wise to utilise its full capabilities, for fear of zeroing the counter. 'Punch-in' recording is not possible. Variable bias allows fine tape tuning of ferric and chrome but not metal; a fact the handbook fails to mention. Dolby B and C noise reduction and tape types are selected by unsatisfactorily small slide switches.

LAB REPORT

Frequency response with metal tape was commendably flat. Centre-position bias adjustment gives falling treble with IEC ferrics and chromes, but proved flat enough with TDK *AD* and *SA* whose slight extra treble sensitivity above IEC make for a fair match. However, this deck has a double-Dolby system, with independent record and replay processors. Tracking between them was poor, resulting in substantially falling treble,

which will introduce dullness into the sound at low levels.

Bias adjustment range was small, but just adequate to accommodate BASF *CR-III* super-chrome and IEC type 1 ferrics. Cheap ferric tapes will sound dull. Checking treble overload (saturation) under variable bias confirmed the small adjustment range. On both ferric and chrome bias adjustment could improve the ability to handle strong treble (10kHz saturation) by up to +3dB — though with bias set to 'detent' the values were a relatively poor -10dB. This fact, coupled with fairly good midband (315Hz) MOLs, demonstrated that bias was basically set too high.

Replay equalisation proved fundamentally accurate, but I was a bit concerned by the fact that every time the machine was stopped and started treble output from the left channel measured differently! At worst, level was -2.5dB at 10kHz, at best -1dB. The right channel was stable though and reached 18kHz without loss — a good performance. In spite of zero high frequency error, Dolby B tracking was poor, due to misadjustment. Musicassette quality will be degraded slightly due to these problems.

There was some potentially audible hum in the replay amplifier, the 50Hz component measuring -58dB; this was present when playing back the deck's own recordings too, as expected.

The transport ran 2% fast, but had a tendency to alter speed by up to 0.5%. Speed was not very constant over a long period, while in the short term wow was fairly low, but spectral analysis revealed substantial flutter peaks, resulting in a poor flutter band-energy level figure of -24dB . This sort of thing adds 'coarseness' to the sound and reduces clarity.

SOUND QUALITY

With metal tape (TDK MA), with no compensatory bias adjustment available, the dullness introduced by Dolby tracking error significantly affected sound quality, making it intolerably woolly. Backing off bias with TDK SA (chrome) to get subjectively correct tonal balance revealed the speed problem, which proved serious enough to affect even non-critical program like electric bass, altering its character. On piano, it could not always hit the notes correctly sounding 'drunken' at times. Speed instability was just as obvious with ferric, adding a distorted, 'polluted' quality to the sound (due to flutter) which rather negated any positive attributes.

Musicasettes replayed at a noticeably fast speed, due to the $+2\%$ error noted earlier. Tonal balance was essentially neutral, but there was a mildly 'honky' quality, noticed especially on cello. Speed stability was again poor, with high rate wow and flutter polluting the sound, except on very uncritical programme.

SUMMARY

Simply and neatly styled, this conventional deck felt quite solid. Operationally, it has some annoyances though, such as manual tape type selection using a very small slide switch, and a self-zeroing counter. Dolby B and C are included, plus manual fine-adjustment of bias for ferric and chrome tape (but not metal) to ensure accurate tape matching.

Sound quality from musicasettes reached a reasonable if not exceptional standard, but obviously played too fast and were polluted by wow and flutter. Recordings were blighted by some speed stability problems, and metal tape additionally sounded woolly and dull with Dolby due to significant tracking error. All in all, this machine's performance was considered poor.

TEST RESULTS

Replay of pre-recorded musicasettes

Frequency response _____ $20\text{Hz}-20.0\text{kHz}$ very good
 Speed accuracy _____ $+2.0\%$ very poor
 Noise _____ -61dB good

Record/replay using blank tape

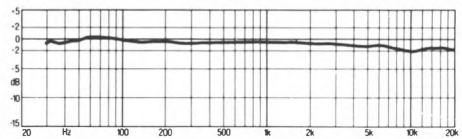
Frequency response, ferric _____ $30\text{Hz}-12.0\text{kHz}$ good
 Frequency response, chrome _____ $20\text{Hz}-18.0\text{kHz}$ very good
 Frequency response, metal _____ $20\text{Hz}-19.0\text{kHz}$ very good
 Stereo separation _____ -49dB average
 Distortion _____ 0.4% very good
 Noise _____ -53dB good
 Speed variation _____ 0.08% good
 Modulation noise _____ -37dB poor
 Flutter energy (band level) _____ -24dB average
 MOL, ferric, $315\text{Hz}/10\text{kHz}$ _____ $+3.5\text{dB}/-8.5\text{dB}$ average
 MOL, chrome, $315\text{Hz}/10\text{kHz}$ _____ $+1.5\text{dB}/-8.0\text{dB}$ good
 MOL, metal, $315\text{Hz}/10\text{kHz}$ _____ $+5.0\text{dB}/-0.5\text{dB}$ poor

Input/output performance

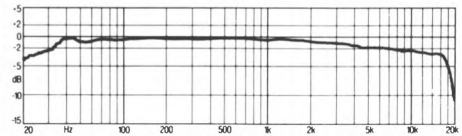
Line in (sensitivity/overload) _____ $65\text{mV}/>3\text{V}$
 Mic input (sensitivity/overload) _____ $0.26\text{mV}/36\text{mV}$
 Output _____ 360mV
 Typical price inc VAT _____ $\pounds 199$

REASSESSED

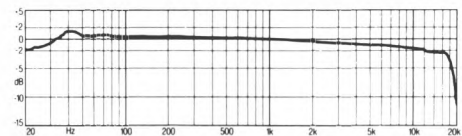
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



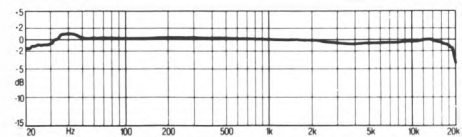
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)



Type II (chrome or pseudochrome)



Type IV (metal)

TRIO KX-880G

TRIO (UK) LTD, 17 BRISTOL ROAD, THE METROPOLITAN CENTRE, GREENFORD, MIDDLESEX UB6 8UP.

TEL: 01-575 6030



Simplicity of style and ease of operation are distinguishing features of this two-head machine. The logic-controlled transport proved smooth and quiet. Except for 'punch-in' record, unusual commands are happily accepted. Auto-search accepted fast reverse from record but only as far as the beginning of the recorded track. Record mode is one-touch and has a master control level with independent channel control.

The peak level meter has a good range of -36 to $+12$, with reasonable resolution. White and red fluorescent blocks make up the display; though bright, they are on the small side for distant viewing. Status displays cover auto tape selection and Dolby B and C. Other features include 'Index Scan,' which plays the first 15 seconds of each tune, and Blank Scan. A Direct Programme Search System allows preselection of tunes from both forward and backward fast reeling. The handbook claims possible selection of up to sixteen tunes. However, we found the system was easily confused, being operated by repeated pushing of the fast forward or reverse keys, and selected tracks were often missed. The

same system using the play key is used for repeated playback — a useful facility perhaps for those who can't get enough of their favourite tracks.

LAB REPORT

Measured replay frequency response has the usual falling treble characteristic which predictably made musicassettes sound 'clothly' and 'soft', with vague imaging. There was not the congestion of time-smearing heard with other decks, however, so the Trio could be said to be reasonable.

Measured speed stability was excellent, as the flutter analysis clearly reveals. The sharpness of the test tone 'spike' at right indicates low drift; low level close-in side spikes indicate low capstan wow, and lack of rubbish at left indicates low flutter. Additional demodulated wow and flutter analysis confirmed these results, and we found that even a most critical piano recording displayed fine purity of tone, perfect pitch solidity and no unsteadiness or speed-induced blemish of any sort.

The single combination record/play head was not especially competent with metal tape,

having an overload ceiling equivalent to the better budget decks. Recordings on metal tape sounded a bit 'jagged' unless levels were kept down.

Bias adjustment is provided, in order to tailor frequency response, but the effect on metal response was not worth having. Adjustment range was also limited with chrome and ferric tapes, being inadequate to 'flatten' BASF CR-III, for example. This facility is currently of very limited use. However, the KX-880 has been adjusted to give nearly flat frequency response at centre position with standard hi-fi tapes, as the graphs show.

SOUND QUALITY

The overall sound quality with TDK MA was very good. Ferric and chrome tapes also sounded natural, although treble softness and diffusion due to saturation were obvious. Trio have set bias high, making saturation effects worse than usual.

SUMMARY

In company with other machines in this price bracket, the 880 was let down by its poor replay-only performance with pre-recorded tapes, and some of the sophisticated facilities such as the DPSS are too complicated for their own good. Otherwise the Trio was easy and pleasant to use, and provided high quality recordings.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 30Hz-10.0kHz very good
 Speed accuracy _____ +0.8% good
 Noise _____ -62dB good

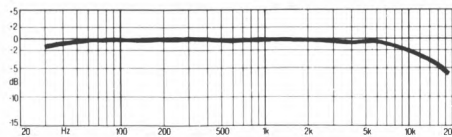
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-17.0kHz very good
 Frequency response, chrome _____ 27Hz-18.0kHz very good
 Frequency response, metal _____ 27Hz-18.0kHz very good
 Stereo separation _____ -48dB average
 Distortion _____ 1.2% average
 Noise _____ -54dB very good
 Speed variation _____ 0.03% very good
 Modulation noise _____ -40dB good
 Flutter energy (band level) _____ -30dB very good
 MOL, ferric, 315Hz/10kHz _____ +4.5dB/-9.0dB average
 MOL, chrome, 315Hz/10kHz _____ +0.0dB/-9.0dB average
 MOL, metal, 315Hz/10kHz _____ +1.8dB/+0.0dB very poor

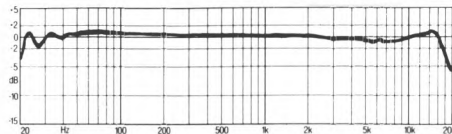
Input/output performance

Line in (sensitivity/overload) _____ 65mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 400mV
 Typical price inc VAT _____ £249

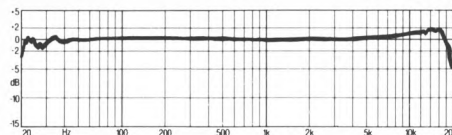
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



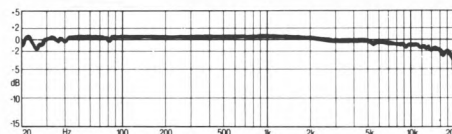
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

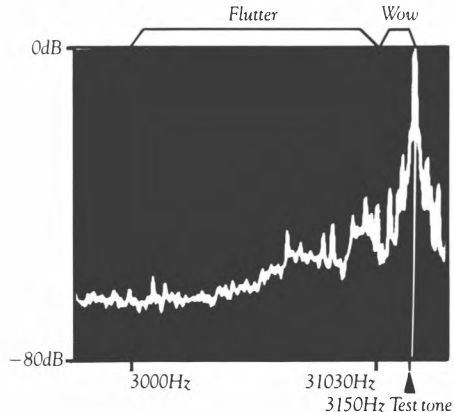


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



YAMAHA K-340

YAMAHA ELECTRONICS (UK) LTD, YAMAHA HOUSE, 200 RICKMANSWORTH ROAD, WATFORD,
HERTS WD1 7JS. TEL: (0923) 33166



Yamaha keep the legend count down on their cassette decks; the '340 is not festooned with spurious lettering. However, what there is rather difficult to distinguish against a dull, black background; bright, white lettering would have helped legibility and ease of use. A rather faceless appearance is reinforced by the lack of indicator lights. The only sign that power is on comes from the tape indicator's small pinpoint of red light, but this is part of an automatic tape-type sensing system — a benefit on any deck, let alone an inexpensive model.

Like an increasing number of manufacturers, Yamaha now fit full logic control to their budget decks. The '340 transport works smoothly and quietly, and can also perform a variety of tricks not otherwise possible, such as fast reverse from record and 'punch-in' recording. Similarly following modern trends, Yamaha have also abandoned microphone sockets, and of course the circuitry that goes with them; doubtless, they are glad to make the savings.

Automatic track search called 'intro-scan' finds gaps between songs on a tape and plays the first fifteen seconds of music following them. 'Block-repeat' and 'auto-replay' functions are also

included. The record level displays use three red and four green LEDs per channel, which offer adequate resolution and range. A superimposed grid gives the appearance of double this number of LEDs, a not uncommon deception.

LAB REPORT

A major technical feature is the inclusion of Dolby HX Pro, which improves overload headroom by modulating bias. That's the idea, at least. Other factors come into play, namely the performance of the head and the quiescent bias level chosen. Tests showed the '304 had a poor midband overload with chrome and metal tapes, but a normal one with ferrics, so HX Pro will prove of limited benefit. The factory alignment of frequency response with blank tapes proved satisfactory, as the ferric, chrome and metal pen traces show.

In the past I have found significant sample variations with Yamaha tape transports, but the '340 submitted for this report exhibited little measured wow or flutter. In listening tests we noted some impurity of tone caused by wow, and some pitch imprecision, but on the whole results were satisfactory. There was no sign of obvious slurring or 'cracked tone.'

SOUND QUALITY

Falling treble in the replay frequency response 'softened' the sound of pre-recorded tapes to the point of dullness. The sound stage was narrowed somewhat also. The '340 sounded no better than most decks in this area — which is to say, not very good.

Listening tests confirmed a trace of brightness with a majority of chromes, while the slight treble fall off with ferric and metal tapes proved useful in practice, balancing the rising response of quality ferric tapes like TDK AD-X and BASF LH-XI. These gave good results whereas chromes sounded muddled at similarly high recording levels. We were less happy with metal tape too, TDK MA sounding a bit flat and dull.

SUMMARY

Yamaha's 340 avoids the practice of providing a flashy appearance to the detriment of performance. However, the facilities include auto-tape selection and Dolby HX Pro, the former much appreciated, whereas the latter didn't give much performance improvement.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 40Hz-12.0kHz good
 Speed accuracy _____ +0.4% very good
 Noise _____ -57dB poor

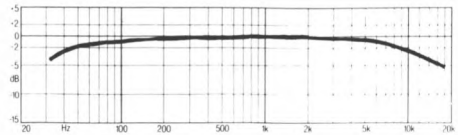
Record/replay using blank tape

Frequency response, ferric _____ 27Hz-15.5kHz very good
 Frequency response, chrome _____ 27Hz-10.0kHz good
 Frequency response, metal _____ 27Hz-16.0kHz very good
 Stereo separation _____ -43dB poor
 Distortion _____ -1.6% poor
 Noise _____ -53dB good
 Speed variation _____ 0.08% very good
 Modulation noise _____ -40dB good
 Flutter energy (band level) _____ -33dB very good
 MOL, ferric, 315Hz/10kHz _____ +4.5dB/-7.0dB good
 MOL, chrome, 315Hz/10kHz _____ -2.0dB/-5.0dB very poor
 MOL, metal, 315Hz/10kHz _____ +1.5dB/+1.5dB very poor

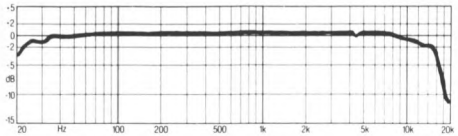
Input/output performance

Line in (sensitivity/overload) _____ 60mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 340mV
 Typical price inc VAT _____ £159

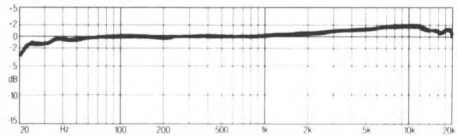
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



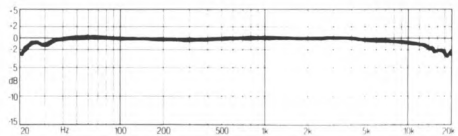
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

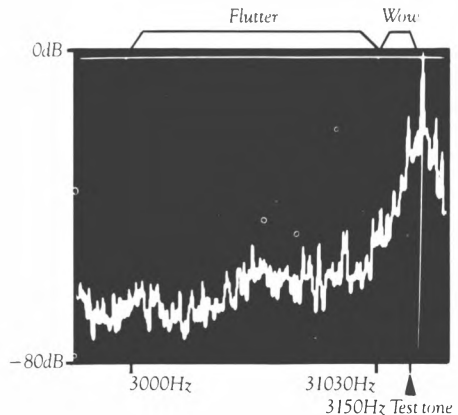


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



YAMAHA K-540

YAMAHA ELECTRONICS (UK) LTD, YAMAHA HOUSE, 200 RICKMANSWORTH ROAD, WATFORD,
HERTS WD1 7JS. TEL: (0923) 33166



Packaged in the customary black box, the K-540 is neatly styled with intelligent use of legends and symbols to facilitate easy operation, even though the limited contrast between the grey lettering and black background compromised legibility. The logic-controlled transport buttons are situated in the centre of this deck. The mechanism operated smoothly, albeit 'squeekily,' accepting unusual commands including 'punch-in' record from play.

Tape selection is automatic, indicated by an LED status display which could have been brighter. Dolby B and C and MPX are manually selected by rotary switch. The K-540 also has Dolby HX Pro which improves the high frequency overload performance of recordings. The fluorescent peak meter has a broad -20 to $+8$ range, and good resolution.

There are a number of search facilities on this machine, but thankfully Yamaha have resisted the temptation to overdo it. 'Intro Scan,' plays the first 10 seconds of each track either in forward or reverse mode; memory allows cue/reverse to any preselected point in the tape; mute locates the gaps for skipping unwanted tracks. And for those tracks you want to hear again and again there is track or full side repeat. Situated in the centre of the deck, beside the transport, a 'Master Fader' is operated by a

vertical slider for fade in/out of recordings. The K-540 has a 'phones socket with independent output control but there are no mike inputs.

LAB REPORT

I have encountered substantial variability in the performance of Yamaha tape transports in a previous issue of *Choice: Cassette Decks*. The '540 reviewed here is yet again a second sample; the first sample with very poor speed stability was unrepresentative, I was told. In contrast, the second sample had good speed stability, as the spectrum analysis shows. Some flutter can be seen, but both low rate wow and drift were minimal. A flutter band-energy level of -25 dB was measured, which is not especially good.

The record level display had 0VU set no less than -5 dB below Dolby flux — an unusually low point. Previous Yamaha cassette decks have always had 0VU set -3 dB below Dolby flux, so I suspect the review sample had suffered some accidental mis-adjustment.

The replay amplifiers had rather a lot of hiss and strong 50Hz hum. With 'normal' tape (120μ S EQ), amplifier hiss was only 2.5dB lower than the bias noise produced by new TDK AD tape. Something like a -5 dB margin is normally achieved.

Replay frequency response had falling treble, as with most decks. Output measured -2.5 dB

at 10kHz which will cause dullness with pre-recorded tapes. The head proved reasonable, if not exceptional, in the maximum flux levels it could get onto tape, but the +2.3dB figure with metal tape was unimpressive. Frequency response with all tape types was fairly flat, as the graphs show.

SOUND QUALITY

Coloration, heard as a 'papery' quality, showed up with metal tape (TDK MA-X) and compromised clarity. Despite even tonal balance there was 'jittery,' 'coarse' treble too. The sound was very 'cassette like' — a sure sign of strong flutter. Tonal balance with TDK AD-X ferric tape was also even, but hiss was evident, because of the unusually low 0VU level, plus the 'papery' coloration. Poor hum screening was detected using BASF CR-EII, plus a 'buzzy' quality to piano notes, due to fast capstan wow. Pre-recorded tapes lacked dynamics and sounded both muffled and confused — as they do on so many decks. There was little high treble.

SUMMARY

The K-540 lacks useful features like user-variable bias, and is a relatively simple deck for the price. As a result it is easy to use, automatic tape type selection helping in this respect. The sound quality of recordings proved competent, but unexceptional, due to mediocre clarity, hiss and coloration. Pre-recorded tapes sounded muffled and confused, and their reproduction was poor.

TEST RESULTS

Replay of pre-recorded musicassettes

Frequency response _____ 40Hz-16.0kHz very good
 Speed accuracy _____ +0.8% good
 Noise _____ -56dB poor

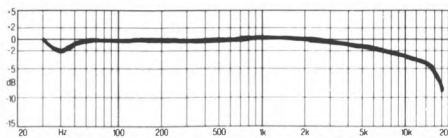
Record/replay using blank tape

Frequency response, ferric _____ 35Hz-12.5kHz good
 Frequency response, chrome _____ 35Hz-16.5kHz very good
 Frequency response, metal _____ 27Hz-18.0kHz very good
 Stereo separation _____ -48dB average
 Distortion _____ 0.8% good
 Noise _____ -53dB good
 Speed variation _____ 0.04% very good
 Modulation noise _____ -42dB good
 Flutter energy (band level) _____ -25dB good
 MOL, ferric, 315Hz/10kHz _____ +3.6dB/-10.0dB average
 MOL, chrome, 315Hz/10kHz _____ +0.6dB/-8.0dB average
 MOL, metal, 315Hz/10kHz _____ +2.3dB/+0.0dB poor

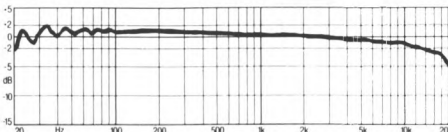
Input/output performance

Line in (sensitivity/overload) _____ 65mV/>3V
 Mic input (sensitivity/overload) _____ None
 Output _____ 380mV
 Typical price inc VAT _____ £209

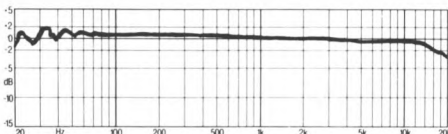
REPLAY FREQUENCY RESPONSE (PRE-RECORDED TAPE)



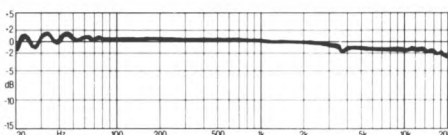
OVERALL FREQUENCY RESPONSES (RECORD/REPLAY)



Type I (ferric or normal)

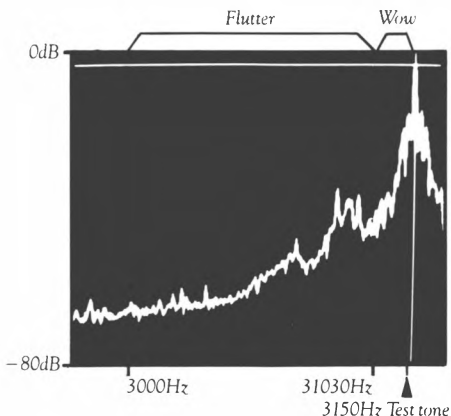


Type II (chrome or pseudochrome)



Type IV (metal)

WOW, FLUTTER AND DRIFT SPECTRUM ANALYSIS



CONCLUSIONS, BEST BUYS & RECOMMENDATIONS

There were some surprises amongst the new models tested this year, with many manufacturers showing distinct signs of improvement. But fundamentally many of the same problems and fads afflicted this year's batch of machines as in previous years, and substantial improvements were difficult to spot.

The main problem is still inaccurate replay response, which kills pre-recorded tapes stone dead as far as sound quality is concerned. Nakamichi are still the only company which consistently and reliably produces a cassette deck that avoids this problem — which is one of many reasons why Nakamichi decks are, to a large extent, out on their own. However, Aiwa also pay serious attention to replay frequency response and generally get it right. I haven't yet heard an Aiwa sound quite like a Nakamichi in this area, but they are close.

Looking through the various reports you might be tempted to think other manufacturers have also got this particular problem taped — Denon, Sony and Marantz, for example. But I wouldn't rely on it: the Denon DR-M20 is just about accurate, the DR-M10 is not; the Sony TC-R502ES is accurate, the TC-K444ESII is not — and so on. In a nutshell, replay frequency response accuracy from other manufacturers currently depends upon which way the wind is blowing.

The fads that plague decks are mainly those of excessive and debilitating gadgetry, which absorb a significant proportion of a unit's manufacturing cost, while even detracting from performance and obstructing usability. For example, many decks are now loaded up with track-scanning facilities that work by detecting a 5 seconds or longer gap between music tracks. These are usually difficult to understand and use, unreliable (as the lists of conditions in the handbooks explaining why they won't work testify), and often displace simpler and more effective items like a counter zero-stop. Even such a valuable facility as automatic tape type

selection may be omitted from a deck which is festooned with search functions.

RECOMMENDATIONS BELOW £200

The outstanding budget machine assessed this year is the **Aiwa AD-F360** (£99), which offers remarkable performance for under £100 and is an obvious Best Buy.

As a result, two favourite models from last year's edition, the **Akai HX-A201** (£99) and **JVC KD-X2** (£99) now receive Recommended status, still clearly rising above the *melee*.

These are joined by two new Recommended models, the **Marantz 151** (£89) and **Teac V-343** (£99), both good value decks with the Trio's performance reflecting its slightly higher price.

Another outstanding new Best Buy model is found at the next price point up, the **Technics RS-B305** (£120) which has a particularly fine transport mechanism and head. The somewhat more expensive **Technics RS-B405** (£167) has a similarly good performance and the addition of dbx noise reduction, but the price is slightly less competitive so the machine deserves Recommendation.

The **Aiwa ADR-550** (£199) is now even more competitively priced than when tested last year. This sophisticated auto-reverse deck has a wide range of useful features and fine performance, and consequently retains Best Buy classification. The **Teac R-505** (£199) is a similarly priced auto-reverse machine of generally good performance which merits Recommendation, though it is not as sophisticated as the ADR550 and holds no advantage over the cheaper *Aiwa AD-R460* (not tested).

RECOMMENDATIONS OVER £200

Reliable quality and even positive sophistication in cassette decks starts above £200, and I'm assured by Denon and Nakamichi that there is no shortage of people prepared to spend this much or even much more.

Meriting Best Buy rating on grounds of its unique portability as well as fine recording sound qualities, the **Sony Walkman Professional** (£229) had a performance which could match the best except in terms of musicassette replay.

The new **Denon DR-M20** (£240) builds on the success of its *DR-M22* predecessor. Retaining the worthwhile dual-capstan drive and three-head configuration, the fine sound quality is now extended to pre-recorded tapes as well as recordings, and the reduced price ensures Best Buy rating. A close competitor for Aiwa-fanciers is the *AD-F640*, which was not reviewed but deserves Recommendation nonetheless.

The **Sony TC-502ES** (£250) is an attractively designed auto-reverse machine with a well balanced performance all round, more than sufficient to merit firm Recommendation. The **NAD 6155** (£249) has a useful replay trim control and performed well in last year's tests, though its Recommendation must now be somewhat reserved in the light of the disappointing results from this year's NAD machinery.

Moving further up the price scale, the **Nakamichi BX100E** (£315) is their cheapest machine. It even lacks Dolby C, but tape aficionados will be aware that Dolby B can actually be better on really high quality recordings, using the best low noise tapes like TDK SA-X. Recording and especially pre-recorded playback quality are ample justification for Recommendation.

The visually attractive **Sansui D-705** (£280) may also be Recommended. With dual capstan drive and three heads, an unusual and useful facility is the ability to tune bias for metal tape, though it is a little pricey. Much the same may be said of the **Nakamichi BX125** (£375), effectively a 100E uprated with Dolby C. Recent tests have again shown 'bright' recordings due to misalignment, so care should be taken in choosing suitable tapes.

The **Technics RS-T80R** (£350) is proof enough that a high quality auto-reverse twin transport 'dubbing' (or editing) deck can be made — albeit at a price. Performance was extremely good, and the benefit of a three-hour record capability is sufficient to justify Best Buy rating.

The generally improved performance of cheaper machines — often from the same manufacturers — means that three fine quality cassette decks in the £300-£400 range are now Recommended, rather than Best Buy rated. The **Denon DR-M33HX** (£320) and **Denon DR-M44HX** (£400) are excellent, easy to use all-rounders, but their competitiveness is now challenged by the new *DR-M20*. The **Aiwa AD-F990** (£349) is another fine machine from this stable, with a particular appeal to the gadget conscious.

RECOMMENDATIONS OVER £400

Six models feature in the exotic priced Recommendations list this year, and two of these particularly stand out. However, it is editorial policy that the terms Best Buy are inappropriate to describe such costly items, so the same overall Recommended status will have to suffice.

The **Nakamichi BX-300** (£595) is distinguished by its ability to extract much more from musicassettes than less costly dual-capstan three-head decks. Then the **Nakamichi CR-7** (£1,350) goes a stage or two further still, and a long way towards justifying that fanciful price tag: it is simply the best cassette deck ever reviewed in *Choice*, and a unique machine. Needless to say, both these upmarket Nakamichis provide exceptional recording capability, and the CR-7 has the additional luxury of accurate automatic tape tuning. The sonic superiority of the similarly priced CR-7 has dimmed the spotlight on the **Nakamichi Dragon** (£1,500) a little this year, but this remains a unique auto-reverse machine.

The **Harman Kardon CD491** (£599) provides real price competition for the BX300, with fine overall performance and a greater range of facilities. The **Pioneer CTA9X** (£700) puts its still higher price to good effect, concentrating on real performance features.

Meanwhile the **Revox B-215** (£1,311) fully maintains the honour of European manufacturers. This pricey semi-professional deck has a wealth of interesting facilities, and turns in a fine performance which provides real competition for the CR-7.

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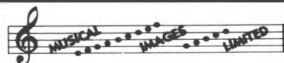
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FERRIC, CHROME OR METAL?

Tape sales figures for the UK consistently show that most people buy cheap ferric tape at around 95p, and all the popular brands at this price point have been tested, with their performance discussed and compared under the 'Budget Ferrics' section. Most of the major brands have been improved since last year, even though their names (eg TDK D) may have stayed the same. Fierce competition between the major manufacturers has hauled budget ferrics up to quite a good standard for everyday, uncritical use. Their main drawback is still hiss (bias noise), even though this has fallen by around 2dB in one year to reach a respectable -50dB. Unlike chromes and metals, ferrics don't vary much in hiss, -52dB for TDK AD being the best currently available.

Chrome tape (chrome-bias) was originally introduced to lessen this limiting factor of cassettes, and has not only retained but increased the advantage. In fact, 1986 sees the majors battling to hit new low chrome hiss levels, so if this factor is considered important, chrome is now a better choice than ever. Good in other performance areas too, and also reasonably priced, chromes remain popular in the UK. I strongly recommend their use to those who want hi-fi quality without the expense of high priced metals.

The prime advantage of metal tape over ferric and chrome is in treble quality. Because it accepts very strong treble signals without overloading and sounding 'diffuse,' metal also improves transients giving a clearer, better defined sound with high recording levels.

However, an important provision on the use of metal tape is that only the best cassette recorders can fully exploit its advantages. One repeatedly hears that chrome sounds better than metal — a viewpoint which may contain more than a grain of truth. There are a number of reasons why. The very high bias levels needed for metal promotes head overload (saturation) in inadequate recorders, limiting the maximum

level that can be recorded before distortion sets in. A glance at the MOL figures (see cassette deck test results) for metal, chrome and ferric tape shows that most decks just cannot do metal tape full justice (use Nakamichi's *Dragon*, or CR-7 as an indicator of what metal can offer). However, this simply observable fact is not the sole reason for metal's often poor sound. The very fact that it can reproduce strong treble, and often has treble emphasis as well, reinforces all the 'nasties' that commonly exist in the recording process. The main problems are distortion and flutter (heard as a form of distortion when severe). These combine to produce that 'sharp,' 'gritty' and 'coarse' quality so often heard from metal tape. Yet a deck which shows these problems can sound quite amenable with chrome and ferric. To hear what metal tape *can* do, you need to use a very good machine, which usually (but not always) means spending a bit of money. Then high recording levels can be used (so minimising hiss, since metal is hissy), and a fine sense of clarity and definition will result. Expensive metal tapes are usually best used on expensive cassette decks — especially ones with tape tuning operating on the metal position, since these can neutralise emphasised treble.

Rising treble is a factor to watch out for when choosing metal tape. In their rush to increase coercivity and treble overload, tape manufacturers have failed to realise just what a drawback it can be. Sony, TDK, and now even Maxell choose to ignore the subjective consequences that the steep treble lift of their metal tapes has upon reproduction. People will continue to claim chrome sounds better than metal as long as brand-leader metals behave like this.

CHOOSING A TAPE

Tape technology is an obscure subject hidden from the consumer by the nature of the end product — a simple 'commodity' that cannot easily be sold on a technical basis. Tapes are largely sold on price, perceived rather than actual quality, and the market image or presence ▶

◀ of the manufacturer. However, there's another way of judging tapes, and this should lead to a sensible buying choice. First, let me explain the all-important standardisation that the International Electrotechnical Commission (IEC) imposed up on the world market some years ago. This has completely changed the market and made it more understandable, even though the tape companies are doing nothing to promote understanding, which is a pity.

There are three IEC Primary Reference Tapes that set frequency response and sensitivity standards worldwide for ferric (IEC Type I), chrome (IEC Type II) and metal (IEC Type IV) tapes (IEC Type III or ferrichrome tape is now dead). Most decks are now adjusted to give flat frequency response and good Dolby tracking (IEC II apart) with these tapes, as the cassette deck frequency response graphs — all made with IEC

Primary Reference Tapes — show.

When buying tapes it is best to start with the IEC-like ones I identify in this report. If they sound either too bright or too dull, then choose a different non-standard formulation having either less or more treble, for compensation. Again, such tapes are identified later in the report.

Every manufacturer now makes an IEC-aligned tape, but sadly few make much of the fact, and some (like BASF, who should know better) obscure things by stamping the IEC logo over highly non-standard tapes like *CR-III*. Tapes having more treble than IEC-aligned types are high coercivity formulations which are capable of reproducing strong treble signals well, but also cost more. Those with less treble are usually — at least in the ferric category — low cost/low coercivity tapes of mediocre performance.

FERRIC TAPES

BUDGET FERRICS

Current budget ferrics have slowly falling treble and a slightly dull sound compared to the IEC *Type I* Primary Reference Tape, but improvements have brought them all closer to its performance for 1986. Most measure around -0.6dB at 10kHz against it, except BASF *LH-EI* which is identical. (This is because BASF make the Primary Reference Tape!)

All budget tapes in the table opposite have falling treble and less sensitivity than the IEC *Type I* Primary Reference Tape, so will sound dull on most modern hi-fi cassette decks. They are best used on 'audio' equipment, such as radio

cassette recorders. There are no clear winners amongst them, but **Philips FE-I**, **Maxell UR** and **TDK D** all offer a good balance of properties, whilst **Memorex DBS** just comes out on top, its superior 53dB dynamic range being very well placed to be exploited by budget decks. **Scotch CX** is included because of its strongly falling treble, which will give a dull sound. It is not meant to be a budget tape, however, so it may not be price competitive with the others.

BASF LH-EI and **Sony HF** are 'budget' ferrics in that they are similarly priced to the above brands and types and are generally to be found alongside ever-popular **TDK D** and **Maxell UR** in stores. However, they are really IEC aligned and so are also included in the next category.

BUDGET FERRICS

Make	treble level	MOL	SAT	hiss	sens.	mod. noise	Price C90*
TDKD	-0.5	+2	-2.8	-50.5	-0.6	-40	1.25
Maxell UR	-0.6	+2	-2.2	-50.2	-0.3	-40	1.19
Sony HF	+1	+2.2	-0.5	-48.4	-0.7	-41	1.15
BASF LH-EI	0	+3	-1.4	-48.5	0	-40	1.29
Memorex dBS	-0.6	+1.6	-3	-51.3	-0.6	-37	1.25
Fuji DR	-0.5	0	-3	-51	-1.5	-40	1.09
JVCF-1	-0.7	-0.8	-3.4	-51.3	-1.8	-40	.95
Philips FE-I	-0.7	+2	-3.5	-49.5	-1	-40	1.20
Agfa Ferricolor HD	-1.2	+1	-3.6	-50	-0.6	-39	.99
Scotch CX	-1.2	+2.8	-3.4	-49.8	0	-38	1.24
Scotch BX	-0.8	+1	-3	-48.6	-1	-39	.99

* Prices quoted in all tables are manufacturer-sourced. Substantial discounts and multipacks are common ie. Budget ferrics are typically £1 each.

IEC ALIGNED FERRICS

(less than +1dB at 10kHz)

These are the best tapes for general hi-fi use on a typical, modern cassette deck. Usually, they cost 20p-30p more than budget types, which puts a typical C90 at around £1.20. Expect a brighter sound with cleaner treble and less muddle at high levels; hiss is little lower, but with Dolby C this may not be such a problem in any case.

The interesting list below contains quite a few

oddities. The most competitively priced tapes should generally be **BASF LH-EI** and **Sony HF**, both of which concede some hiss by way of compromise. Note also that **Memorex MR-XIS** has good dynamic range and fine compatibility. Memorex have traditionally proved very good at offering at least one tape in each category that is a perfect IEC replica, MR-XIS being such a ferric.

Every year, **TDK AD** comes out as one of the best all-round ferrics, and this year it retains this ►

Make	treble level	MOL	SAT	hiss	sens.	mod. noise	Price C90*
TDK AD-X	+1	+4.5	+0.3	-50.3	0	-39	2.00
TDK AD	+1	+2.8	0	-52.2	0	-38	1.75
Sony HF-ES	+0.9	+4.2	0	-51.3	+0.8	-39	1.65
Sony HF	+1	+2.2	-0.5	-48.4	-0.7	-41	1.15
BASF LH-EI	0	+3	-1.4	-48.5	0	-40	1.29
Maxell UD-I	+0.6	+4	-0.8	-51	+0.3	-40	1.49
Memorex MR-XIS	0	+3.6	-1.8	-49.8	0	-38	1.49
JVC UF-I	+0.5	+3	-0.8	-51.6	0	-38	1.29
Scotch XS-I	+1	+0.4	-1	-51.8	-0.5	-39	1.40

*Typical prices: £1.20-£1.60.

◀ title, but only just. It has less hiss than any other ferric, plus good overload headroom. But note how close **JVC UF-I** and **Maxell UD-I** are, and both of these are likely to be keenly priced. **Scotch XS-I** is quiet, but suffers very limited overload headroom compared with the other

tapes.

Sony HF-ES is a high performance, IEC-aligned ferric obviously designed to combat **TDK AD-X**, which it does quite successfully. Both are likely to be expensive as ferrics go, but are excellent tapes in the IEC *Type I* category.

FERRICS WITH STRONG TREBLE

With the exception of tapes like **TDK AD-X** and **Sony HF-ES**, most top quality ferrics have markedly rising treble, giving them a bright sound on a typical IEC-adjusted cassette deck. In spite of their high treble overload ceilings, I have reservations about these tapes because of their poor compatibility. If your cassette recorder gives a dull sound when recording onto ferric tapes though, give some of the following a try.

For me, the most curious tapes in this group are the new **Maxells**. I can normally see the logic behind a formulation, but **XL-IS** and **XL-I** are very odd: they have low hiss, but not low enough to make up for poor overload headroom (MOL) at 300Hz. All other performance figures are mediocre and sensitivities strangely low. I noticed variability in **XL-IS** behaviour, one of the four samples tested having +2.5dB MOL 315Hz, for example. The same sample also had better sensitivity, so I suspect Maxell may have a problem with this new tape. In any case, even

assuming best case results, neither **XL-I** or **XL-IS** matches **Sony** and **TDK** top ferrics.

Of the other tapes, **BASF LH-M1** and **LH-MX1** are likely to be most competitively priced, and they have very good all-round performance. However, **Sony HFS** and **Fuji FR-IS** might provide price competition, and are equally good. **Thats FX** is usually expensive, although undoubtedly a good tape. **Agfa Superferro HD-X** has unusually poor overload headroom in the midband (MOL 315Hz) plus excessive treble, making it a real oddity of very poor compatibility.

I suggest that the ferrics in this category are best used with decks having variable bias or automatic tape tuning. However, remember that cranking up bias to flatten their treble lift will reduce treble overload (saturation) but increase midband overload (MOL 315Hz). The net result will be a performance little different from top quality IEC-aligned ferrics like **TDK AD** and **AD-X**, **Sony HF-ES**, etc. The best choice will ultimately depend upon price and whether or not you own a variable-bias deck.

Make	treble level	MOL	SAT	hiss	sens.	mod. noise	Price C90*
Maxell XLI-S	+1.2	+1.2	-1.5	-52	-1.2	-39	1.99
Maxell XL-I	+1.9	+2	+0.4	-51	-0.7	-39	1.75
Sony HF-S	+1.9	+4.2	+0.4	-50.7	+0.4	-40	1.39
BASF LH-M1	+1.3	+2	-0.3	-51.3	-0.6	-42	1.65
Fuji FR-IS	+1.9	+3.6	+0.5	-50.2	-0.3	-41	1.55
Thats FX	+1.4	+3.8	-0.3	-51	0	-40	1.99
Agfa Superferro HD-X	+3.5	-0.7	+1	-52	-2	-40	1.39

*Typical prices: £1.50-£1.90.

CHROME TAPES

This category is where all the action is. Ferrics improve slowly, metals arguably don't improve at all in the truest sense of the word, but chromes are now changing rapidly, due largely to their substantial and increasing market share.

The description 'chrome' only applies strictly to a few of the tapes in this group, those having a chromium dioxide coating (BASF CR-EII and CR-MII, Philips UC-II and MC-II, Agfa Stereochrom HD and Superchrom HD-X). Otherwise, the pigments used are cobalt doped ferric oxide, and more recently metal powder, and are often referred to as 'pseudochrome' types.

In the past, distinct differences existed between the performance of these surface coatings, but some of these have now been swept away. Pure chromes traditionally display little hiss or modulation noise, but have limited overload headroom. Their proponents, notably BASF, have validly argued that this gives them a

dynamic range that is more easy to exploit, and that the benefits are better appreciated by those who simply record 'up to the red' on their cassette deck record level indicators.

That BASF's chrome tapes had equal or superior dynamic range to Japanese pseudochromes was established in last year's tape tests, their main limitations being low sensitivity (CR-EII), or excessive treble (CR-MII), both characteristics that compromise compatibility with Japanese cassette decks.

This year, the situation has changed. TDK have decided to produce equivalent low hiss, IEC-aligned tapes. They are really chasing the large German and smaller European chrome tape market, but TDK tell me that these 'European' tapes will also be on sale in Japan for the first time too. In effect, they now agree that BASF was right — which isn't necessarily good news for BASF, as can be seen from the test results.

Because chromes don't fall into the same neat ►

IEC ALIGNED 'CHROMES'

Make	treble level	MOL	SAT	hiss	sens.	mod. noise	Price C90*
TDK SA-X	+0.4	+2.2	-3.2	-58	+2	-41	2.50
TDK SA	+0.8	+1.4	-3	-57	+1	-40	2.25
TDK SF	+0.2	+2.2	-3	-53.2	+1.2	-40	1.85
BASF CR-EII	+0.4	+2.5	-4.6	-56.5	0	-45	1.99
Maxell UD-II	-0.2	+1	-4.3	-55	+1.1	-40	1.59
Memorex CD-XII	-0.3	+2	-0.5	-53.3	+2.6	-38	3.95
Memorex CR-XII	+1	+0.6	-3.3	-53.7	+0.9	-40	1.99
Memorex HB-XII	-0.3	+2.5	-3.6	-55.2	+1.8	-42	2.89
Scotch XSII	-0.4	+1.2	-4.5	-55.2	+1.1	-42	1.79
Agfa Stereochrom HD	-0.3	0	-6	-56.5	-0.6	-45	1.65
Philips MC-II	+0.3	+2.6	-5	-57	+0.4	-39	1.20
Philips UC-II	+0.3	+2.6	-4.5	-56	+0.2	-45	1.60
Thats EM-X	-0.3	+2	-0.5	-53	+2.7	-38	2.55
Thats EX	-0.4	+3	-0.5	-51.7	+3.5	-40	1.89
Sony UX-S	+0.4	+2.8	-2.5	-53.2	+2	-43	1.75
Sony UX	-0.8	+1.8	-4.4	-54.6	+1.6	-40	1.55

*Typical prices: £1.30-£1.70.

◀ price/performance categories as ferrics, they have been divided into two groups — IEC-aligned, and 'the rest'. The former are compatible with modern decks and should be a first choice when buying. The latter exhibit rising treble and are best used on decks with tape tuning.

The sheer length of the list is in itself interesting; most chromes are now close to the IEC II Primary Reference Tape in terms of frequency response, if not sensitivity, (which has always been a bone of contention). The majority of cassette decks are now set up to be compatible with chrome tapes that have a sensitivity of around +2dB on the previous list, +1.5dB to +2.5dB being an acceptable variation for accurate Dolby tracking.

The most astonishing tape of 1986 is undoubtedly new **TDK SA-X**, exhibiting a new all-time low in hiss of -58dB. A midband overload ceiling of +2.2dB gives a total dynamic range of 60.2dB. It may appear at first sight that Sony **ES** metal tape beats this with its 60.6dB of dynamic range, but this is only so on the Nakamichi **ZX-9** used for the tape tests, which can record to high level on metal tape. The average cassette recorder cannot, which is why **BASF** have always argued that low noise is more useful than high overload limits in producing useable dynamic range). Add the facts that **SA-X** will be cheaper than most metal tapes and is IEC-aligned, ensuring good compatibility, and you have one amazing tape.

TDK SA follows the low noise path of **SA-X**, losing about 2dB dynamic range and having a brighter sound. It is still an excellent tape though, and remains recommended, as always.

These two tapes now lead European manufacturers, where once the latter excelled. **BASF CR-EII** remains a fine tape, little changed from last year, with low noise, a flat frequency response, and good overload headroom, giving it a still-formidable 59dB dynamic range, the equal of **TDK SA**. Low sensitivity remains a problem, but this should be countered to some extent by very low prices.

Philips UC-II and **MC-II** also remain interesting tapes, as noted last year, but I have still to see them in any shop!

Then there's **Memorex**. They have also been busy re-formulating to remain competitive in the IEC Type II slot. **CD-XII** is a metal tape for use at chrome bias, which has a sudden treble lift

above 10kHz. High sensitivity emphasises the effect when Dolby is used, virtually guaranteeing a bright sound, while the high hiss level restricts dynamic range to 55dB, and mod noise is also high. The main advantage of **CD-XII** is that it accepts strong treble without overload.

In truth, the less expensive **Memorex HB-XII** is more impressive. It has low hiss at -55dB and good headroom at +2.5dB, providing 57.5dB of dynamic range. Frequency response is flat, mod noise low and sensitivity correct too, so this **Memorex** tape is highly recommended.

Scotch XS-II is similar to **HB-XII**, except for a lower overload margin and therefore less dynamic range. This is still a good all-rounder though, with excellent compatibility.

The least expensive **Memorex** tape, **CR-XII**, is hissy with a poor overload ceiling, and doesn't compare well with **TDK**'s budget chrome — **SF**. The latter has better overload headroom and is usefully compatible. Another inexpensive compatible chrome tape is **Maxell UD-II**, which is a direct competitor for **TDK SF**. Of the two I slightly prefer **UD-II** for its lower noise and slightly 'softer' sound.

Agfa Stereochrom HD has poor overload margins, but makes up for them to some degree with low hiss. However, very low sensitivity and falling treble will result in a dull sound on most decks. This tape may well be available at a low price, in which case it may be worth trying by those who find chromes generally sound bright on their recorder.

I'm not quite sure what new **Thats EX** is meant to offer over **EM-X**, unless it sells at a lower price, since the two are very similar. Both are metal tapes operating at chrome bias; whereas **EX** has more hiss than its stablemate, it has an equivalently better overload margin and a similar frequency response. Sensitivity is very high, compromising compatibility.

The brand new, **Sony UX** and **UX-S**, have some unusual properties. **UX** is the only modern chrome tape to exhibit strongly falling treble. It will sound dull as a result on the majority of modern decks, but like **Agfa's Stereochrom HD**, this may prove an advantage on decks that have a bright sound with all other chromes. **UX-S** is more properly IEC-aligned, but has high hiss only partly ameliorated by high overload headroom. The result is a 56dB dynamic range, which is not impressive.

CHROMES WITH STRONG TREBLE

Make	treble level	MOL	SAT	hiss	sens.	mod. noise	Price C90*
TDK HXS	+0.6	+3	+0.5	-52.7	+3.2	-39	2.75
Maxell XL-IIS	+1.2	+1.3	-3.5	-56.7	+1.2	-43	2.25
Maxell XL-II	+1.4	+0.3	-3	-55.6	+0.5	-40	1.99
Sony UX-PRO	+2.3	+3	0	-54.4	+1.3	-44	3.49
Sony UX-ES	+2.2	+3	0	-54.4	+1.3	-42	2.79
Fuji FR-II	+1.2	+2.5	-2.5	-54	+1.3	-43	1.75
JVC UF-II	+1.3	+1.8	-2.5	-56	+1.1	-39	1.79
BASF CR-MII	+1.7	+3.4	-2.8	-56.8	+0.7	-44	2.35
Agfa Superchrom HD-X	+1.5	-0.5	-4.6	-56.5	-0.8	-45	1.89

*Typical prices: £1.80-£2.40.

The above list is supposed to contain all tapes with more than +1dB of treble lift at 10kHz, relative to the IEC II Primary Reference Tape. **TDK HXS** at top of the list appears not to fit this criteria, but like Thats *EM-X* and Memorex *CD-XII* — also metal tapes operating at chrome bias — *HXS* has a sudden and steep treble lift above 10kHz that gives a piercing sound on an IEC-aligned recorder. High sensitivity causes Dolby noise reduction to emphasise the effect further, making matters worse in practice than they appear from the test figures. Whereas both Memorex and Thats have sought to tame this treble peak — notice their negative treble level results — TDK have not bothered. Consequently, *HXS* sounds much brighter than either of the others, having +5dB treble boost at 20kHz. As always with metal tape there's strong hiss, which limits dynamic range. High overload limits are not adequate compensation, especially to the user who records 'up to the red' and no further.

Maxell's two new premium grade chromes both have treble lift, **XL-IIS** rising steeply to +3.6dB at 20kHz, while **XL-II** flattens out a bit above 10kHz. Maxell have obviously adopted BASF and TDK's low hiss/low MOL philosophy for these new formulations, but have not yet managed to achieve equal results, hiss being a bit higher and MOL lower. *XL-IIS* has a dynamic range of 58dB, which is 2dB less than TDK *SA-X* and *SA*, or BASF *CR-EII*, giving them a bright sound on most decks.

BASF CR-MII chrome tape also has strong

treble lift above 10kHz, being +4dB at 20kHz. This is its greatest limitation, so I recommended use on variable bias decks, whereupon its 60.2dB dynamic range — equal to that of TDK *SA-X* — and low mod noise make it one of the best sounding tapes available. *CR-MII* is one of my preferred tape choices in the chrome slot.

The two top **Sony UX-PRO** and **UX-ES** chromes are both new formulations and show enormous amounts of treble lift. They therefore have a very bright sound with seriously compromised compatibility. Like the Maxell tapes and BASF's *CR-MII*, I recommended use on a variable-bias deck or one with automatic tuning to neutralise the effect. A dynamic range of 57.4dB is not comparable to TDK's rival tapes. Interestingly the ceramic tape guides of the *UX-PRO* cassette reduced mod noise by 2dB compared with *UX-ES*, so they are obviously effective in smoothing out the running properties of the cassette.

The New **JVC UF-II** is an interesting formulation, well balanced by combining low noise with a reasonable overload ceiling. The rising treble output will give a bright sound on most decks.

Fuji FR-II is running this year's race with last year's brew. It's noisy, like the Sony tapes, and therefore has limited dynamic range. **Agfa Superchrom HD-X** is very insensitive, encouraging Dolby to dull its inherently bright sound. Very low overload ceilings compromise performance.

METAL TAPE

Metal tapes are expensive and suffer more hiss than chrome (Sony ES being a sole exception), but balancing this are very high overload figures, especially at high frequencies — an area where cassette tape has traditionally been poor. However, the enormously strong composite bias/music signal the head must handle to magnetise metal tape generally causes the head to overload before the tape. A look through the IEC Type IV (metal) MOL test figures of the cassette decks confirms this, metal tape in practice usually showing a lower overload ceiling than ferric at 315Hz.

Judged purely from test figures, it might seem that metal is actually not better than ferric or chrome in practice. However, our listening tests show that treble clarity and good transient definition are two quite substantial subjective benefits, when using a reasonably competent recorder. Hiss only becomes intrusive with Dolby B or without noise reduction.

The most common complaint I hear about metal is that it has a 'harsh', 'gritty' sound. There's a specific reason for this — and it's getting worse. All Japanese manufacturers set up their recorders to be compatible with the IEC Type IV Primary Reference Standard Tape — because it's made by TDK in Japan. Unfortunately, as metal tapes improve, their treble

output increases, and most now differ significantly from the Primary Reference Tape in terms of relative sensitivity, or in effect, frequency response.

Rising treble results in the sharp sound people hear, 'grittiness' and 'coarseness' being attributable to distortion and flutter added by the cassette deck. This year, all the major manufacturers' metals have stronger treble than ever, and ideally should be used on decks with appropriate tape tuning — they really can be painfully sharp sounding otherwise. (Note that not all variable bias controls operate on the metal position.) A glance at the Treble level column in the test results indicates the extent of this problem.

TDK MA-X remains a good all-rounder, but the rising treble gives a bright sound on most decks. Once upon a time the classic solution was to use **Maxell MX**, but this is now reformulated, and gives a positively weird performance. Clearly low hiss was one objective, dropping 2dB to a respectable -54dB. However, treble output has been boosted by 2dB at 10kHz, giving a bright sound; worse still, MOL has fallen from +5.6dB to just +2.4dB, this 3.2dB drop actually reducing dynamic range to 56.4dB, though what is there is now more useable. Variation in the four MOL test results suggests some variability, while metal tapes are usually very uniform between samples.

Make	treble level	MOL	SAT	hiss	sens.	mod. noise	Price C90*
TDK MA-X	+1.2	+5	+3	-53.5	+0.8	-41	3.50
TDK MA-XG	+1.2	+5	+3	-53.7	+0.6	-42	4.99
Sony ES	+1.7	+5.6	+3	-55	+0.6	-40	4.49
Thats MR-X PRO	+1.4	+5.6	+3.7	-52.5	+1.2	-39	3.69
Thats MG-X	0	+2	+1	-52.5	-0.8	-40	2.99
JVC ME	0	+4.6	+2	-51.8	+0.3	-38	2.29
Maxell MX	+1.2	+2.4	+1.8	-54	-0.4	-43	3.49
Scotch XSM IV	-1.6	+2.5	-0.3	-52	-0.3	-39	2.70

*Typical prices: £2-£4.

Sony Metal ES isn't an altogether happy upgrade either. Four samples had flatter treble than those tested in 1985, which was promising. Then Sony announced a reformulation and a single new sample was promptly tested, only to find enormously raised treble, output measuring +1.65dB at 10kHz (+3dB at 20kHz) compared with the Primary Reference Tape. Strangely, nothing else had changed, so the tape has got worse overall, not better! It still has very low hiss and high MOLs, but is now less compatible than before.

Thats MR-X PRO has very high overload ceilings, but also high hiss levels and very strong treble lift — like new Sony ES. Most recorders won't be able to utilise its headroom effectively. **Thats MD-X** is an altogether different proposition, having a flat frequency response and therefore broadly compatible. High hiss and limited overload headroom restrict dynamic range, however.

JVC ME is much the same. It's good on compatibility, but has a lot of hiss. Dynamic range is better than **MG-X** due to higher

overload margins, but this does rely on having a recorder good enough to exploit the fact. If **Thats MG-X** or **JVC ME** are available at a low price, they may be worth trying. Note, however, that both tapes have little to offer over advanced ferrics like **TDK AD** and **AD-X**, other than the ability to accept stronger treble signals.

Finally, there's **Scotch XSM IV**. Gains from reformulating since last year proved miniscule — or even losses! Dynamic range remains the same, but has become more useable, both hiss and MOL/SAT going down 1dB. However, frequency response now displays strongly falling treble, measuring -1.6dB at 10kHz, relative to the IEC Type IV Primary Reference Tape. This is the biggest treble loss to be recorded of all tapes tested — ferrics, chromes and metals. **XSM IV** is therefore very incompatible, but some may like its dull sound.

The 1986 metal re-formulations are particularly unsuccessful, making metals less attractive than ever, I regret to say, except for those who own very high performance decks with metal tape tuning.

TAPE CASSETTE CONCLUSIONS

This year has seen some unusual, even bizarre, tape reformulations — especially amongst the Japanese big three: **TDK**, **Maxell**, and **Sony**.

Most perplexing is the new *black* series **Maxell** tapes. I found significant variability between samples and final performance that was not only non-standard, but arguably inferior to their predecessors'. Luckily, the tapes which haven't been reformulated continue to represent **Maxell's** abilities well: **UD-I** and **UD-II** are excellent IEC-aligned tapes in the ferric and chrome categories that may be recommended, and the new budget ferric **UR** is also a good tape.

I was similarly surprised by the non-standard nature of many of **Sony's** new tapes, seeing that they offered no appreciable benefits over more standard and compatible formulations. **UX** and **UXS** are generally good, compatible chromes

worth trying, but **UXES** and **UX-PRO** have a very bright sound and are best used on decks with tape tuning. The **Sony** ferrics all proved decent, but again watch out for strong treble. **TDK** have adopted an entirely different, and in my opinion more sensible strategy, attempting to combine high performance with compatibility, and largely succeeding in this difficult process. Moreover, they have significantly re-aligned parameters to lower the overall level of the dynamic range window, so that decks can more easily exploit it. In other words, the hiss has been substantially reduced, along with some loss of MOLs too, but the overall dynamic range has increased. All **TDK** tapes may be recommended except chrome bias **SF** and **HX-S**, and **MA-XG**. **TDK AD** remains one of the best ferrics available and **SA** and **SA-X** are excellent chromes. Metal **MA-X** retains a bright sound (not usually excessive), plus good headroom. ►

◀ **BASF** tapes remain significant in what they offer too. The chromes, **CR-EII** and **CR-MII** are really excellent tapes, a bit hampered by low sensitivity (**CR-EII**) which Dolby converts into a dull sound, and excessive treble (**CR-MII**) for which tape tuning is needed. Both are very quiet, have extremely low modulation noise and flutter, and fine treble output stability that gives a cleaner, more neutral-sounding treble than Japanese pseudo-chromes. Until TDK **SA-X** came along, **CR-MII** had more dynamic range than any other tape on the market, including all the metals. Ferric **LH-EI** is a very inexpensive perfectly IEC-aligned tape with fine compatibility, if a bit hissy. Newer **LH-MI** and **LH-MX1** have a bright sound, but less hiss.

Memorex have some very compatible tapes of good performance in **MR-XI** ferric and **HB-XII** chrome, both of which I strongly recommend as worth trying. Of **Thats** tapes, **EM-X** and **MG-X** are most notable, the latter being a flat response IEC-aligned metal — and just about unique as such. This is a metal tape without a piercing treble, which is a rare animal these days.

JVC re-enter the UK tape market with some interesting tapes in **UF-II** and the metal tape, **ME**. **Philips** also have some fine tapes **MC-II** looking very good this year but availability is poor. **Fuji** have a competent, but unexceptional range, but **Scotch** and **Agfa** remain back-runners in the competitive tape field.

TAPE TECHNICAL APPENDIX

This section outlines the tape tests and explains what information they provide.

IEC STANDARDS

The tests accord as far as possible with the methods proposed in IEC94, Part 5, May 1982. Original Primary Reference Standard tapes are used, not secondary or 'transfer' versions. Reference level is IEC 0dB, equal to 250nWb/m (5% max. error), taken from the official (BASF) IEC calibration tape.

The recorder used is a Nakamichi ZX-9 that accurately meets IEC replay equalisation standard (Prague 1981, a requirement of IEC94). All new test results are directly comparable with those in the last edition (issue No42), showing what changes manufacturers have made.

The test system was set up and validated using the same standards as, and with some sample tapes from the last edition, to ensure near-perfect repeat accuracy on all measurements, error being in the order of 0.5dB or less. Measurements were made by a Hewlett Packard 3561A FFT analyser, Radford ANM1 audio noise meter with CCIR and IEC A-weighting, and Radford low distortion oscillator Type LD05. Four C-90 samples of each tape were requested and tested, quoted results being the average.

TEST BIAS

Test bias was that used in previous years, established as the bias typically used on cassette decks from the recorded MOL tests with the IEC Primary Reference Standard tapes. This is set by MOL315 alone (3%k3), not the MOL/SAT balance as many people seem to believe (due to difficult wording of IEC94). Bias levels were:

TEST BIAS

IEC I (ferric)	+3dB
IEC II (chrome)	+1dB
IEC IV (metal)	+4dB

FREQUENCY RESPONSE

In themselves, tapes don't have a frequency response. However, they have a response relative to the IEC Primary Reference Standard Tapes, for which cassette decks should now be accurately adjusted (see replay frequency response plots in the cassette deck tests). This relative response was measured on the FFT, and the level at 10kHz relative to that at 200Hz gives the 'treble level' figure.

This test employs equalised pseudo-random noise to generate a long term (1000) average response for each IEC Primary Reference Standard tape. Tapes under test are then compared to this reference response, using mathematical processing to produce a cross-spectrum (50Hz–20kHz).

The information reveals whether a tape will sound bright or dull on a recorder set up to give a flat frequency response with the IEC Primary Reference Standard tapes.

MOL 315Hz

This was measured using a 3% third-harmonic distortion limit, the quoted level being relative to IEC 0dB. This parameter is what I term the 'overload ceiling' of a tape in the midband of the audio spectrum, and with many tapes has actually fallen this year, as manufacturers have moved away from high overload in favour of low noise.

SAT 10kHz

This is the absolute maximum signal level a tape will accept at 10kHz, quoted relative to IEC 0dB, and is the 'overload ceiling' of a tape at high frequencies, being a measure of its ability to record strong treble. The unusually high quoted values for ferric tape especially, are a direct function of the ZX-9's high performance independent record and replay heads.

BIAS NOISE

More commonly known as tape hiss, this was measured using the IEC option of CCIR-weighting (instead of IEC A-weighting).

SENSITIVITY

This is sensitivity at 400Hz, relative to the Primary Reference Standard tapes. With chrome tapes, the IEC *Type II* Standard sensitivity is unrepresentative of the norm, so I use +1.5dB as correct for accurate Dolby tracking. The Standard tape is soon due to be replaced by a more representative one.

MODULATION NOISE

This is measured using Band Noise from 3000Hz to 3130Hz, in the presence of a 3150Hz stimulation tone recorded to IEC 0dB level. Mod noise is caused by random amplitude and frequency modulations caused by jittery tape travel. It is a good indicator of tape surface smoothness and treble output stability.

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
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






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SOUND ADVICE, 162 Alcester Rd, Mosley, Birmingham. (021) 449 3328. A&R, Creek, Linn, Manticore, Naim, Nakamichi, Nytech, Onyx, Rega, Revox. Dem facilities 2

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WARSTONES HI-FI STUDIO, 54a Warstones Rd, Penn, Wolverhampton. (0902) 345114. Dem facilities 3 rooms. Open Mon-Wed 10-6. Thurs-Fri 10-9. Sat 10-6. Home trial facilities, free installation. Credit cards: Access, Visa, Eurocheque. Service dept.

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