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**Presented at
the 2nd Regional Convention
1987 June 17-19
Tokyo**



AES

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AN AUDIO ENGINEERING SOCIETY PREPRINT

THE RELIABILITY OF R-DAT CASSETTE TAPE

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Abstract: Following the approval of the DAT Technical Standard in July 1986, the recorders and the tapes have been sold in the market since the next March.

Fuji Photo Film demonstrated the R-DAT cassette tape at the Japan Audio Fair in October 1986, and brought it to the market under the name of AXIA[®]DA₁ in the same month as the recorders came to the market.

This paper reports the electromagnetic transfer characteristics, durability and other important features of AXIA[®]DA₁.

1. INTRODUCTION

The DAT Technical Standard was approved in July of 1986 after many experiments and technical discussions continuing for more than three years since the DAT Conference started. In the October of 1986, several decks and tapes for the R-DAT system were demonstrated at the Japan Audio Fair. The recorders and the tapes appeared in the Japanese market in the next March.

The R DAT system has many advantages over the conventional analogue system, the following three being the most typical.

-1 High quality sound

The frequency response higher than 20 KHz and the dynamic range greater than 90dB have been obtained.

-2 Wide applicability

The capacity of subcodes of the DAT system is some four times as large as that of the Compact Disc system. This enables us to play various trick modes. A typical example is the high speed music search which is almost 200 times as fast as the normal playing.

-3 Long playing time in comparison with the cassette size

Continuous 2 hour playing(and recording) in the standard mode with the cassette which is half as small as the conventional compact cassette.

In this report we wish to describe the characteristics and features of the AXIA[®]DA₁ tape.



Fig.1 AXIA DA-120

2. ELECTROMAGNETIC TRANSFER CHARACTERISTICS.

According to the R-DAT format shown in Table 1, digitization is carried out with the sampling frequency of 48KHz and 16 bit linear quantization for each of the two channels under the standard mode. The system has three other option modes having the recording density equal to that of the standard mode. Accordingly we are not going to discuss the option modes hereafter.

Table 1. R-DAT FORMAT
(Standard Mode)

Number of Channels	2 ch
Sampling Frequency	48.0 KHz
Quantization Law	16 bit Linear
Linear Recording Density	61.0 KBPI
Packing Density	114 MBPI ²
Transmission Rate	2.46 MBPS
Sub-Coding Capacity	273.1 KBPS
Modulation	8-10
Error Correction	Doubly-Encoded RSC
Tracking	Area Divided ATF
Cassette Size	73x54x10.5 mm
Recording Time	120 min.
Tape Width	3.81 mm
Type of Tape	Metal Powder
Tape Thickness	13±1 μm
Tape Speed	8.15 mm/s
Track Pitch	13.591 μm
Track Angle	6°22'59.5"
Standard Drum	∅30, 90° wrap
Drum Revolution	2000 rpm
Writing Speed	3.133 m/s
Head Azimuth Angle	±20°

Table.2 AXIA¹DA₁ Tape

Magnetic Pigment	Super Fine Metalix
Binder	3DS Binder
Base	UST Base
Back Coating	SDR Back Coat
H c	1500 O e
B r	2600 Gauss
Squarness Ratio	0.8
Thickness(in total)	13.0 μm
Base	9.4 μm
Magnetic Layer	3.0 μm
Back Coat Layer	0.5 μm
Under Coat Layer	0.1 μm
Tape Width	3.81±0.02 mm
Tape Width Fluctuation	less than 6μmPP
Transmission	less than 5%
Cassette Size	73x54x10.5 mm

It should be noted that the linear recording density and the packing density are as high as 61 KBPI and 114 MBPI², respectively. Table 2 shows some specifications which are related to the reliability of the AXIA¹DA₁ tape.

Table 3 gives the electromagnetic transfer characteristics of the AXIA¹DA₁ tape. The block error rate (B.E.R) is one of the most important figures of this system. Its value varies with the type and with the individual of decks, as well as with the location within a tape. AXIA¹DA₁ tape has the B.E.R. value close to 10⁻⁴ which is well below the tentative tolerance limit of this system (10⁻³).

Table 3. RF Characteristics of AXIA 「DA」

Optimum Current	+0.4 dB
Output 4.7MHz	+0.2 dB
0.13MHz	-0.1 dB
F-Response 4.7M/1.2M	-0.2 dB
1.5M/0.13M	+0.5 dB
Overwrite 1.2M/4.7M	-1.1 dB
0.13M/1.5M	-1.2 dB
C/N (4.7M/3.7M)	+0.2 dB
Block Error Rate *	1.8×10^{-4}
OVERWRITE B.E.R *	$\sim 3.4 \times 10^{-4}$
* : by SONY DECK DTC-1000ES OTHERS vs MONOSASHI TAPE	

Table 4 Durability Data of the Search Test (40°C80%RH)

		AXIA 「DA」	another Sample
Tape Running		OK	STOP
B • E • R	Search Part	Decreases	X 1.8
	Switch (PCM) Point	Decreases	X 8.0
	(SUB)	Decreases	X 10.0
PlayBack Part		Decreases	X 2.5
RF Output Level		-0.2 dB	-0.8 dB
Envelope Schema		OK	-2dB
Analogue Output		OK	Muting
T • A • P • E	Search Part	OK	• Helical scar • Adhere • Crater
	Switch Point	OK	
	P.B Part	OK	
Head Clogging		None	87P/300P

3. DURABILITY

A special requirement for the durability of the DAT tape is that it has to withstand the repeated high speed search on a same point. We wish to focus on this characteristics because this typifies the durability. Fig 2 shows the mode of the search-durability test carried out under the environments of 40°C-80%RH, 25°C-60%RH, 23°C-10%RH and 5°C-30%RH. Operation mode change were conducted by using the subcodes. The results obtained under the severest condition (40°C-80%RH) are given in Table 4. It clearly shows the reliability of this tape.

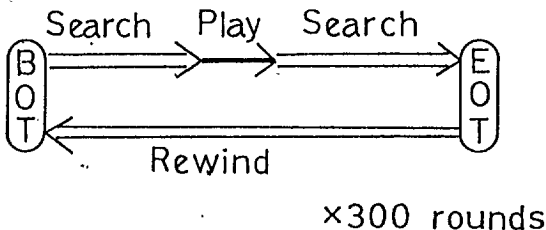


Fig.2 Search Test Mode

4. CASSETTE (CARTRIDGE)

The R-DAT cassette has hubs but no flanges in contrast to other cassettes of the helical scan magnetic recorder systems. The hub structure has the advantage of the smaller size, but the tape behavior is remarkably affected by the design and adjustment of the guide system of the deck. This is often the cause of the increase of the

friction torque, which may lead to stopping of the running tape in an extreme case. Unfortunately, the individual decks may differ in the height and the perpendicularity of the guides. Thus the tape has to have an enough allowance to stand all these fluctuations. In order to satisfy these requirements, we developed the rectified rib structure, as well as the new type of friction sheet and S.D.R. back coating layer. Their effect will be shown in Fig. 4. It is easily found that the increase of the friction torque after repeated random search is very small.

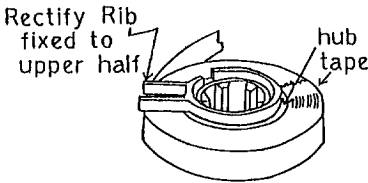


Fig.3 R.R. Mechanism

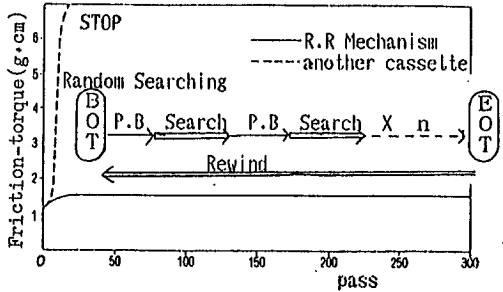


Fig.4 Friction-torque Characteristics under Random Searching

5. CONCLUSION

The characteristics of the AXIA¹DA₁ tape was discussed from various viewpoint. The data assure the high standard of its electromagnetic properties, runnability and durability in every operation mode.

ACKNOWLEDGEMENTS

The authors would like to express sincere gratitude to many engineers of recorder manufacturers for helpful suggestions throughout the research and the development of AXIA¹DA₁.

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