

CREATIVE COMPONENT

IS IT LIVE? OR IS IT TAPE?

TO:

WILLIAM L. JOHNSTON, ED.D.
DIRECTOR OF CONSUMER RESOURCE CENTER
OKLAHOMA STATE UNIVERSITY

FROM:

HOAT HUU NGUYEN

DECEMBER 2, 1986

TABLE OF CONTENTS

Chapter	Page
I. Introduction	1
Nature of Problem	2
Statement of Purpose	3
Method of Study	4
Summary	4
II. Introduction	5
Development	7
Types of Tape	8
Characteristics of Cassette Tapes	13
Proper Care and Storage	17
Summary	20
III. Introduction	21
BIBLIOGRAPHY	26

LIST OF TABLES

Table	Page
I. Summary of Tape Qualities (Audio)	23
II. Summary of Tape Qualities (Video)	25

IS IT LIVE? OR IS IT TAPE?

CHAPTER I

Introduction

Recording tape, as a finished product, is as different in quality and texture as variations of the basic four color group. Tape can be purchased for as little as forty cents for a sixty minute audio cassette to fifteen dollars for a high grade quality of video tape. Considering this spectrum of pricing the qualities and types vary even more; thus providing the ability of lesser qualities of tape to be sold in a better quality level.

Logically if the price of a tape is higher the quality should also be higher. This is not necessarily the case. For instance a standard grade of video tape, VHS or BETA, regardless of manufacturers will cost within a dollar of each other. But, considering the manufacturer's process, the quality could say greatly.

The grading process has a two fold purpose. The first is to qualify the best uses for that grade. Secondly, the price level it will fall under. Names such as Maxell, TDK, Memorex, Scotch, Fuji, Panasonic, to mention just a few, all

have their own manufacturing process, quality control checks, and materials not to mention marketing differences. Considering this information can be very helpful in getting the best quality for the best price.

Nature of Problem

It has been said many times about certain foods: "If you knew what was in it, you wouldn't eat it." The same can be said about tape products: If you knew what you were really buying, you wouldn't think it was a such a good buy.

Frugal consumers should ask questions when they make their purchases but they may not understand the technical answers. There is a lot of information given on these products but assimilation can be difficult if the terminology is superlative to the level of comprehension. Therefore, the information given could be used in decision-making or, as is often the case, ignored. Since the largest consumer percentage is the general public, the need to simplify the information is necessary. Customarily, a purchase is made for one or two reasons: need and/or desire. In either case the final decision will be based on 'the best for less'. Tape manufacturers have endeavored, in some cases, to explain the advantages of their products but unless the consumer understands "frequency response", "signal to noise ratio", "bias", "equalization" and "saturation levels", not to mention the purpose for the four types manufactured, the information will not benefit them in

their purchase.

In today's marketplace acquiring the best for less is the consumer's primary interest. A simplified explanation of this information would enable the consumer to evaluate the purpose, quality and price of the product most fitting to their need.

There are questions that can be asked and understood when shopping for tape products. These are:

1. What is tape?
2. How does it work?
3. How long should it last?
4. Is the tape the only consideration?
5. Why are there different types?
6. Are all brands the same?
7. What care does it require?

Statement of Purpose

Having so much technical information available on recording tape prompts this report in an effort to explain this information on a consumer's level. The purpose is to take the different types of manufactured tape and their particular recording capabilities and convert it to usable, easily understood language.

In this report the objective will be to:

- A. Define the four different types of recording tape
i.e., ferric, CrO_2 , ferric-chrome, and metal.
- B. Describe the different characteristics of the tape

types in relation to frequency response, signal to noise ratio, etc.

- C. Discuss durability characteristics of tape transports, as well as proper care and handling of same.

In addition to this information, it will enlighten the consumer with a general history of recording tape and its future.

Method of Study

This report is based on a review of literature ranging from encyclopedias and technical books to consumer report magazines. The information obtained from these sources is of a technical nature, but will be expounded on in such a way as to define in layman's terms the value of their function in regards to the information's worth in the consumer marketplace.

Most all of the information given in this report is of value in purchasing the best, most functional product available at the best price.

Summary

Tape is depended upon to accurately record our past, present and future. The survival rate of these records will not be known unless we are aware of the abilities of the recording medium and materials on which they are recorded.

CHAPTER II

Introduction

From earliest times man has sought to imitate the sounds of nature by mechanical means. The first serious attempt to simulate the human voice by mechanical means (as far as is known) was the colossal statue of Memnon at Thebes. This was built in the eighteenth Egyptian dynasty, about 1490 B.C. Carved in stone with a series of hidden air chambers, Memnon was supposed to emit a vocal greeting each morning at sunrise to his mother, Goddess of the Dawn. That it did produce some sort of sound was testified to by Strabo, who visited it in 7 A.D. But it was toppled by an earthquake in 27 A.D. Although restored in 196 A.D. by Roman Emperor Septimus Serurus, its alleged power of speech was gone! (Ebers 1959)

From those earliest times in history up through current technological break-throughs of today and tomorrow, man is ever trying to imitate the sounds and now sights of nature to such a fine-tuned degree that mother nature herself could not tell the difference. During all this progress and advancement in invention there were no means of establishing quality--good, bad or indifferent. If it was designed, built and operating it was considered good, useful, the best. From these prototypes standards were established.

In 1876, Alexander Graham Bell's telephone transmitted speech by mechanical means. A year later, born

from similar experimentation, Thomas A. Edison designed and built the first phonograph which reproduced recorded sounds repeatedly. Continuing his experimentation, he was able to improve and build an even better apparatus with even better standards (Read & Welch 1959, p. 11).

Standardization--the starting point by which industry began qualifying the capabilities of its developments and products. Standardization--in manufacture, public acceptance and world acceptance--was necessary to such an extent that the world was in constant qualification conflicts. Standards of quality, operation and public preference had to be made and adhered to so that no one would ethically want to drop below them.

As invention after invention appeared on the consumer market, numerous improvements were made. It was no longer the telephone, the phonograph, the car. Now there were brand names, styles, personal need designs, sizes and colors. All of these changes derived from the idea that: "Everybody's different! Let's appeal to them all!" From tin foil recordings where can it go?

During the middle of World War II, magnetic wire recording reached the experimental stage. At the end of the war many tape machines were brought back to America from Germany. Magnetaphon was manufacturing paper backed magnetic tape for broadcasting (Read & Welch 1959, pp. 425-426). It revolutionized the world. As the quality of tape

improved, more flexibility was realized; tape, with its greater versatility, could do the job easier, faster, better with the final product more resilient to replays.

In the years since World War II, both disc and tape have dominated the market with many changes in product materials and quality of effectiveness. The industry, through standardization, qualified the abilities of their tape products by placing the information on the package for consumer evaluation. The problem was, unless the person was knowledgeable in the terminology, it was virtually useless. Therefore the attitude of the general public, when purchasing tape products, was and is: "A tape is a tape." But that is not the case. Today there are more brands and qualities of tape on the market than colors in a rainbow. In spite of this variety, however, the price does not vary accordingly.

Development of Tape

Recording tape has not always been the flat strands of brown or black plastic ribbon that we know today. The first magnetic recordings were done on wire measuring approximately 0.004 thousandths of an inch. It was demonstrated by Valdemar Poulsen in 1898. The wire was made from a stainless steel alloy. Except for minor details the techniques for wire recording were not unlike tape recordings. For example, the magnetic head had a slot cut in it which produced a more even recording on the wire.

Wire recorders were commercialized after World War II. Since 1950, however, the wire has been almost completely replaced by magnetic tape (McGraw-Hill Encyclopedia of Science and Technology Vol. 14, 1960, p. 665).

One of the advantages tape had over the phonograph disc was that it could be recorded on, erased and recorded on numerous times. Its advantage over the wire was the ability to trim, edit, splice and add tape to the film. The entertainment industry developed many different uses for both audio and video tape.

Types of Tape

The first compound to be used successfully was rust, technically known as ferric oxide or ferric tape. It is still widely used today but other tapes have also been developed such as: chroma tape (CrO_2) which is coated with chromium dioxide, ferri-chrome tape which is a combination of the two and metal tape which is coated with pure oxidized metal. Although many different tapes were developed in an effort to improve the quality of the reproduction, few people can agree on which compound does the best job (Lyttle 1981, p. 121). The most important questions to consider are: Who manufactured these compounds, what quality of processing was used and how well does the finished product perform? It can be argued that the processes work but they do not all work the same way.

The properties comprising tape remain basic. They

all start with a magnetic substance of some sort which is adhered in some way to a pre-cut size of synthetic material, polyester (mylar) or acetate. From that point, the product fragments off into almost as many types and qualities as there are granules on a piece of tape. In every instance, the steps of the process are the same; but the quality and quantity of materials and the guidelines used in those steps give the tape entirely different qualitative abilities and weaknesses.

By reason of these various standards, some products will have less than adequate concentrations of magnetic properties decreasing their ability to properly duplicate the electrical impulses of a recording. These differences begin in the mechanical agility and strength of the compound and its binder (adhesive) to remain on the film during multiple recordings and playbacks. Upon inspection of a lower quality tape, there is an inconsistency in the color, thickness and texture. In some cases, after little or no use, there will be large pieces of the compound missing from the film. This is caused by an inadequate binder which allows the compound to separate and become embedded in the tape path of the tape recorder. This is technically known as "signal drop-out" (McGraw-Hill Encyclopedia of Science and Technology Vol. 8, 1960, p. 41).

Inferior binders do not always reveal themselves in the form of missing compound. More frequently, inferior

compounds and binders break down much slower than in complete separation. Each time a tape is used a powdery residue is left in its path. This residue is actually the compound which has been rubbed off the tape's surface. Consequently, repeated use will create a concentration of this residue on the tape path producing a magnetic field which acts as an eraser of the signal from the tape. This results in another form of signal drop-out. In all forms of signal drop-out the quality and the life of the tape is drastically reduced.

Depending upon what particular manufacturer's product is being observed, the individual names will vary only slightly, as well the special uses they are designed for. Every manufacturer will boast of better signal to noise ratio and frequency range which all depends on their superior secret formulas. "Frequency response" is a measurement used to determine the ability of the particles to duplicate the electrical impulse properly. "Signal to noise ratio" is the measurement between the amount of signal on the tape and the amount of noise level in the tape (Runstein 1974, pp. 54-58).

The major brand manufacturers have broken down their quality tapes into four levels. In succession, the levels are metal tape, high resolution ferric/chromium formulas, ultra-dynamic range and the last being the standard low noise formula.

As previously described, these four levels each enjoy

specialized formulation to acquire their classifications of ability and price. Three of these levels require functions found in most quality tape recorder/players in order to attain their optimum abilities. These functions are in the form of circuitry found in the recorder/player which enhances the signal in such a way as to place it most effectively into the tape. The three types of signal enhancement is noise reduction, equalization and bias.

Noise reduction is circuitry found in most quality machines. It is commonly found to be Dolby B system. This system, simply put, boosts the high frequency portion of the signal higher and reduces it back to normal on playback. At the same time it reduces the high frequency down it cuts the level of tape noise or hiss as well. This also increases the signal to noise ratio.

There are two other terms, controlled by the electronics in the recorder that effect the quality of the recording. "Equalization" (EQ) is an effect added to the signal to strengthen the high frequency portion of the program before it is put on the tape. In playback the boost is removed, weakening the high frequency portion of the signal and, at the same time, weakening the noise. This improves the signal to noise ratio of the recording (Lyttle 1981, p. 121).

The last term is "bias". Bias gives an over-all strengthening to the signal as it is put on the tape,

overcoming weak areas in the sound signal so they will not be detected in the playback. The bias signal is about 4 times higher than the signal it is strengthening thereby placing it well above the range of human hearing (Lyttle 1981, p. 119).

All these methods of determining tape quality are audible deviations. The effects that they have on the finished product will make a difference in the quality of what is heard and will also determine how long that quality will last.

The only type of tape not requiring special circuitry in the machine for optimum performance is what is most commonly referred to as standard or low noise formulations. This formula depending on the quality of materials and process is considered a general purpose tape able to record all signal to an acceptable level. It is most usually not used for high fidelity recordings or recordings where the reproduction must be quality, with minimal or no distortion. This type is more susceptible to distortion because of its low saturation level and signal retention. It also will have a lower signal to noise ratio, having a higher level of hiss due to its reduced formulation qualities. "Distortion" is caused by different problems in the recording process. In this definition, it is caused by applying a higher level of signal than the particles can handle (McGraw-Hill Encyclopedia of Science and Technology Vol. 8, 1960, p. 41).

The other types of tape manufactured are, or should be, of a better quality than the standard low noise tape and require the special circuitry in the recorder/player to utilize these formulation enhancements. When recording without these circuits a cleaner recording will be achieved and a lasting quality but not the circuit enhancements the formula was designed to capture.

Understanding the elements and functions of the tape will provide the consumer with a basic knowledge of what tape is and will also give him an insight into how it works.

Characteristics of Cassette Tapes

In the first part of this paper, tape has been discovered, advanced, dissected and its weaknesses expounded upon. For open reel tape, this information is sufficient; but what about audio and video cassettes? When one or both of these is purchased, what is obtained is much more than tape. It is a tape mechanism. The tape mechanism (housing) covers, protects and assists in the proper operation of the tape in the recorder/player. If this housing is not properly manufactured and cared for, the tape's life can end when the mechanism malfunctions.

In cassette operation, the principle is basically the same as the open reel. However, one major difference is that the open reels are firmly affixed to the unit and the tape is threaded through tape guides mounted on the unit which control the feeding of the tape over the heads. In

cassettes, the reel hubs are loose in the cassette housing and the tape guides are not part of the recorder but a part of the housing. This difference is very important in reducing "cross talk".

"Cross talk" is a term used to describe what happens when the tape does not track accurately on the pre-recorded tape. This causes faint reproductions of the other tracks to be played along with the main tracks. Other terms used in determining the ability of a tape recorder/player are "wow" and "flutter". These terms are used together to define the ability of the recorder to properly record and play back the recording without encountering surges and/or drags in the transport and inconsistent tension of tape in guides and pinchrollers.

All of these problems can be difficult to overcome in video cassettes and, even more so, in audio. The quality of the case and the mechanics inside determine extensively the tape's performance. Roller guides, tension pressure pads and close hub-to-case tolerances will all determine how well the recording or playback will be. Some manufacturers claim that the way a case is sealed can also have an effect on a tape's performance. Several forms of sealing are snap-lock, gluing and screws. Evenly torqued screws are the preferred choice for optimum housing assembly. The construction of the case and the tolerances used will also determine if the tape will drag or jam--characteristics prominent in lower quality tapes.

Video cassettes are the most sensitive of the various types of tape. Although similar, video cassettes do not operate the same as audio cassettes. When the video tape is engaged in the record or play sequence in the video cassette recorder (VCR), the protective door is lifted up and arms in the VCR pull the tape out of the housing and wrap it around and against the erase, record/playback and sound heads. In this way the tape is more accurately controlled and guided along the tape path. Inside the cassette are working parts also similar to an audio cassette but due to the more sensitive demands of the video tape there are a series of rollers, guides, levers and springs. All of these gadgets have the task of keeping the tape straight, clean and operating. Consequently, the video cassette is more sensitive to bumps and dropping than the audio cassette and must be rewound completely before it is stored.

Unlike the audio recorder/player heads which are stationary, video heads are mounted on a high speed rotating drum. This method of reading the signals is much harder on tape than being dragged over a stationary head. Video tape, therefore, must be of higher quality than audio tape. Unfortunately, there are as many different qualities of video tape as there are audio. Since the quality of a video tape has much the same range and requirements as an audio tape, the lower the quality purchased the shorter the life span.

With all the pre-recorded tapes available today, most VCRs are used primarily for playback. The two most popular reasons for recording are to record a program that cannot be watched when it is on or to record a special event or movie that is to be kept indefinitely. There is a fast-growing third reason which requires an additional piece of equipment--a video camera. Recordings made with a video camera are usually the type of recording that will be stored for years and replayed often.

In a recent independent testing of 50 grades of nineteen different brands of tape the top four, after evaluating all grades, were TDK, MAXELL, FUJI and Panasonic. These tests were done on video tape only (Video, February 1985, pp. 86-112). To determine a personal preference in audio or video tape, checking independent tests and reading about the different brands and grades can be very helpful. In most cases the information provided is easy to read and understand.

What about the equipment the tape is being purchased for? Whether it is audio or video, the cost of the equipment ranges from \$75 to \$250 (audio) and \$275 to \$750 (video). In either case, an investment such as this should definitely play a part in what quality of tape should be used. Inferior grades will not only produce inferior quality but will also operate poorly in the equipment resulting in serious problems and reducing the overall life of the unit. Most units come

with a book of information that not only gives instruction in operation and unit capabilities but also suggestions in the best brands and grades of tape to use. Since many manufacturers produce their own tape, these suggestions will usually reflect their name. However, the units will operate as well, if not better, with other brands of the same quality. Experimentation should give some insight into the best brand and quality needed for the job.

Proper Care and Storage

If tape were observed in a container without the binder (adhesive) and the mylar carrier, it would appear to be a very soft powder similar to graphite (Maxell Tape Guide, p. 26). The basic concept describing a tape's performance ability is found in this powder. Very close observation of the granules in this powder reveal small, irregular shaped pieces of metal. These pieces are actually little, programmable fragments that, when set in a particular form, duplicate the signal that put them in that pattern. When looking at the pattern of these fragments on raw (unused) tape, they are aligned; in other words, their north and south poles are in opposite directions. When a recording signal is applied to the tape, these fragments actually move in relation to the original alignment creating a mirror image of the electrical impulse in magnetic form. The magnetic picture can then be converted back to the electronic impulse by utilizing the playback circuits of the

recorder. These fragments determine the quality of tape. The ideal characteristics would be proper size and shape which would allow for maximum density of the particles on the tape. The higher the number of particles, the better the "frequency response" and "signal to noise ratio" and the less chance of signal drop-out and "distortion".

A good quality tape is designed to give satisfactory service for many years. However, this length of time can be drastically reduced by careless storage and handling. Elements that should be avoided in storing tape are heat, dust, humidity and magnetism.

Heat can cause considerable damage or destroy a recording completely. Open flames, heating elements, heat producing appliances and direct or indirect sunlight should be avoided. The ideal temperature for storing tapes is between 50° and 70°F (Video February 1985, p. 84).

Dust also contributes to the mortality rate of a recording. A tape which is continuously exposed to dust and/or a dry environment can develop static electrical charges which will effect it much the same as a magnet. The frequency will be gradually reduced in the upper levels stealing the brightness, presence and fidelity of the recording and increasing the noise level. The mylar or acetate can also dry out causing the edges of the tape to curl, split and separate from the binder.

Moisture can cause tape to stick together effecting

the surface when pulled apart. The binder can break down and be pulled away from the acetate carrier. Moisture is usually followed by drying out. The tape cannot survive these adverse conditions. Laboratory tests have determined approximately 50% humidity is ideal for tape storage (Video February 1985, p. 84). For long term enjoyment of a recording, these precautions must be adhered to.

Since recordings are made on tape by means of magnetism, magnetic objects or anything that generates a magnetic field must be avoided. The same principle that applies the signal to the tape can also erase the signal from the tape. Speakers are one magnetic source on account of the magnets placed on the back. Televisions have a degaussing coil or electromagnet designed to demagnetize the picture tube each time the set is turned on. Power transformers, found in many appliances, and electric motors are both made operable by means of electromagnetism.

Another place that is not often considered as having magnetic qualities is the tape player itself. Oxide debris from tape binders build up in strategic areas in the tape drive. Heads, pinch rollers and capstans can become caked with these oxides and create minute magnetic fields in the tape path. For this reason, the tape path should be periodically cleaned and degaussed (demagnetized).

The amount of oxide buildup and the length of time between cleanings is determined by how often the machine is

used and the quality of the tapes which are played. Lower quality tapes have inferior materials which shed oxides with every pass and require more frequent cleaning of the recorder as opposed to higher quality tapes that have superior materials and binders. But the purchase of a superior quality of tape and proper storage habits will not insure longevity if there is incorrect handling of the tape and/or its mechanism.

Summary

For whatever reason the tape is used, it does not necessarily designate what brand, or quality of brand, to use. All tape, be it audio or video, will do the job it was designed to do. The difference is how well it will do that job. In this case the main question is: What kind of performance is the purchaser looking for? If the preferences are not specific, any tape will be suitable. However, if a good reproduction of sound or video is needed, the purchaser should then seek one or more of the popular brand names on the market.

CHAPTER III

Introduction

Magnetic tape is so widely used today it is as commonplace as the pen; and, like the pen, there are more styles, sizes, shapes, qualities and uses than one person can imagine. The market is flooded; in fact, if you did not know what you really wanted in the product you were buying, you bought the first thing you saw with the best price.

I have had an interest in stereo equipment and specialized tape recording for a few years. However, when I first started, I did not understand all the special language and terms involved in the equipment or, most especially, in the tape. My attitude was: "a tape is just a tape. They are all alike." Then I noticed that some tapes were a little more expensive than the tapes I was buying and I could not understand why. I read the information but it was foreign to me. In addition, my equipment was not exactly "top-of-the-line."

Then I met a friend who was knowledgeable in the quality of equipment and specialized recording. He increased my desire to learn more about these two areas. In the process, I finally learned what all the terms referred

to on tape packages and what they meant. I discovered, for the difference in price, I was actually paying more for the less expensive, lower quality tapes. I was also reducing the life span of my equipment.

The information and terms simplified in this text and the tables that follow would have helped me to understand the principles of operation and methods of evaluation of the tape products. I have recordings today that I made from records or other tapes that are not pleasant to listen to simply because I did not know about the different tape qualities, superior recording equipment and techniques and the proper handling and storage of tape. They say that hindsight is always better than foresight. Oh, to do it all over again!

The information available in the tape industry is limited. There has not been very much written on the subject especially on a level that would be appealing or understandable to the people who use it most--the general public.

SUMMARY OF TAPE QUALITIES (AUDIO)

Type	Grade	Characteristics	Retail Price*	Use
1. Most tapes that are bulk packed or offbrand w/o any information or warranty	Poor	tape is lighter color of brown (tan) indicating inferior formulation, inferior binder resulting in high level of drop-out and formulation deposits on recorder/player mechanism, premolded case, usually glued, loose wheels. NO BRAND NAME, HIGH NOISE LEVEL, LOW SIGNAL REPRODUCTION	Average .40-.90 each	full range, use on all machines, not recommended if tape is to be played numerous times, or is to be saved for considerable length of time, or desires quality reproduction and/or high fidelity qualities. VERY LIMITED FREQUENCY RESPONSE, SPEECH, SOUND, MUSIC
2. Low Noise (LN) TDK AD, MAXELL LN, etc.	Average, usually considered least quality in line of brand name manufacturers	color is darker, formulation and binder somewhat better depending on manufacturer. Cleaner tape, usually has limited warranty; some premolded snap cases, brand name uses screws, NOISE LEVEL BETTER, SIGNAL REPRODUCTION BETTER	Average .90-1.00 each	Full range, all machines. Not recommended for high fidelity, reproduction or storage. LIMITED FREQUENCY RESPONSE, SPEECH, SOUNDS, MUSIC

* Prices will vary depending on the outlet shopped. As a rule, specialty stores will have sale pricing, where chain department store and wholesale houses pricing could be lower due to volume buying.

Type	Grade	Characteristics	Retail Price*	Use
3. Low Noise-- High Output ULTRA-DYNAMIC, UDXL	Good	Good color, binder, low drop-out, warranty, better cases w/screws, S-D ratio better USE DOLBY AND EQ EQUIPPED MACHINES FOR BETTER PERFORMANCE	1.10-1.60 each	Full range, BETTER FREQUENCY RESPONSE, ECONO- MIC QUALITY MUSIC AND STOR- AGE GOOD. Fidelity all machines
4. Ferri-chrome CRO ² , UDXL I & II, SUPER-AVYLON, etc.	Very good	Excellent color, binder, formula superior frequency response and s-n ratio, excellent signal cap- ture, high impact plas- tic case, screw as- sembly, accurate tracking reels and guides. OPERATES BEST WITH MACHINE SPECIAL CIRCUITRY-BIAS-EQ, DOLBY B, C, DBX NOISE REDUCTION	1.90-\$4.50 each	All machines un- limited, excel- lent storage, HIGH FIDELITY REPRODUCTION, HANDLES REPETI- TIVE PLAYING WELL
5. METAL	Excellent	Same as CRO ² plus uses special metal circuitry, best S-N ratio, highest output, lowest distortion. DOES NOT REQUIRE NOISE REDUCTION	5.00-8.50 each	Mastering only or special pro- ject, audiophile preference, only used on machines w/metal cir- cuitry. WASTE OF MONEY AND MATERIAL ON ANYTHING LESS.

* Prices will vary depending on the outlet shopped. As a rule, specialty stores will have sale pricing, where chain department store and wholesale houses pricing could be lower due to volume buying.

TABLE II
SUMMARY OF TAPE QUALITIES (VIDEO)

Type	Grade	Characteristics	Retail Price*	Use
1. STANDARD	Average-good	Depending on brand, formula varies from good color and sharpness to very grainy picture with color bleeding. Usually type level where off-brand manufacturer slip the inferior grade tapes and cases at good grade pricing.	4.50-8.00 each	General purpose, suggested for temporary recordings, not for long term storage.
2. HIGH STANDARD-HIGH GRADE	Good-Excellent	Superior formula to most standard formulas, high resolution and color reproduction durable. USUALLY FOUND IN BETTER QUALITY NAME BRANDS.	9.00-15.00 each	Specialty usage, for camera, long term storage.

* Prices will vary depending on the outlet shopped. As a rule, specialty stores will have sale pricing, where chain department store and wholesale houses pricing could be lower due to volume buying.

BIBLIOGRAPHY

- Braithwaite, Lancelot. "The Official Video Magazine Blank Tape Test Part I." Video Magazine, February 1985.
- Clifford, Martin. Microphones--How They Work and How to Use Them. Blue Ridge Summit, Pennsylvania: Tab Books, 1977.
- Davidson, Homer. Servicing Cassette and Cartridge Tape Players. Blue Ridge Summit, Pennsylvania: Tab Books, 1974.
- Dbx 122 Instruction Manual. Waltham, Massachusetts: Dbx Inc., 1977.
- Grossworth, Marvin. Home Video. Garden City, New York: Dolphin Books/Doubleday and Company, Inc., 1981.
- Lyttle, Richard B. The Complete Beginner's Guide to Stereo. Garden City, New York: Doubleday and Company, Inc., 1981.
- Maxell Tape Guide. Moonachie, New Jersey: Maxell Corporation of America, 1983.
- McGraw-Hill Encyclopedia of Science and Technology Vol. 8. New York: McGraw-Hill Inc., 1971.
- McGraw-Hill Encyclopedia of Science and Technology Vol. 12. New York: McGraw-Hill Inc., 1971.
- McGraw-Hill Encyclopedia of Science and Technology Vol. 14. New York: McGraw-Hill Inc., 1971.
- Read, Oliver, and Welch, Walter L. From Tin Foil to Stereo. Indianapolis, Indiana: Howard W. Sams and Company, 1959.
- Runstein, Robert E. Modern Recording Techniques. Indianapolis, Indiana: Howard W. Sams and Company, Inc., 1974.
- Video Equipment Buying Guide Vol. 388. Skokie, Illinois: Lewis Weber, 1985.