

# TALK

SOUND

FROM THE MAKERS OF "SCOTCH" BRAND MAGNETIC TAPE

BULLETIN NO. 10

## LAYER-TO-LAYER SIGNAL TRANSFER IN ROLLS OF MAGNETIC TAPE

When a length of recorded tape is wound into a reel, each layer of tape is in the magnetic field of its neighbors. Since any magnetic material placed in a field tends to be magnetized to some degree by it, each layer is magnetized to some extent by its adjacent layers. The important point is the degree of the magnetization, which may vary from totally undetectable, the normal condition, to nearly as large as the adjacent layer, in case of accidental exposure to external magnetic fields. While our investigations have been quantitative, this brief summary will be largely qualitative, and concerned not with explanations or theory, but with the major techniques in keeping the effect small.

The effect is non-linear; i. e. transfer is like recording with no bias. The transfer level will decrease perhaps 2 db. for each 1 db. decrease in recording level. Thus, ordinarily effects are noticed, if at all, only as a result of a very heavily modulated or overloaded portions of tape. Therefore, the signal to transfer ratio may be increased by lowering the recorded level.

The effect increases with time of storage, over a period which may vary from several days to several months depending on the

conditions of storage. In practice, transfer cannot usually be detected except after considerable time.

The effect increases with temperature. The temperature coefficient is not the same for all tapes and all times of storage, but is approximately 1 db. per 10° F. Thus it is advantageous to keep recorded reels in a cool place.

The transfer effect is usually well below the noise level if the recorded reel is kept away from all stray magnetic fields. Such fields (A.C. or D. C.) can act to increase the transfer by a few or even 30 or 40 db. Most cases of objectionable transfer can be ascribed to this cause. Whereas fields of the order of several hundred oersteds are required to cause even a measurable erasure and one or two thousand oersteds for complete erasure, transfer may be noticeably increased by fields of only a few oersteds. It is therefore, important for the highest quality work to keep the recorded reel away from any sources of stray fields such as motors, heavy power lines, magnets, etc.

The effect is frequency dependent, with middle frequencies most important. Low

Magnetic Products Division



"SCOTCH" is a registered trademark of the 3M Co., St. Paul 19, Minn.

frequencies are weakly transferred because the field strength associated with long wave lengths is less than with shorter wave lengths of the same magnetization. This coupled with the non-linear amplitude effect makes very long wave lengths unimportant in transfer. High frequencies are weakly transferred because the non-magnetic backing layer of the tape causes a much higher attenuation of the fields of very short wave lengths than of longer wave lengths. Some decrease in transfer can be effected by the use of thicker backing material, but the difference is mainly in the higher frequencies.

It should be emphasized that the problem of transfer is not bothersome to an average user. The effects discussed are generally well below the noise level of the tape and special efforts are necessary to detect and

measure them. The existence of transfer at an annoying level is fair evidence of neglect of one or more of the above principles. This follows from our quantitative tests and also from the fact that extremely few users have ever detected the phenomenon. Noticeable signal transfer is not a necessary evil of tape recording, but merely a possible hazard.

To summarize, we may avoid noticeable layer-to-layer transfer of signals in rolls of recording tape by:

- 1) Recording below the overload point of the tape
- 2) Avoiding exposure of recorded rolls to magnetic fields
- 3) Avoiding storage of reels in hot places.