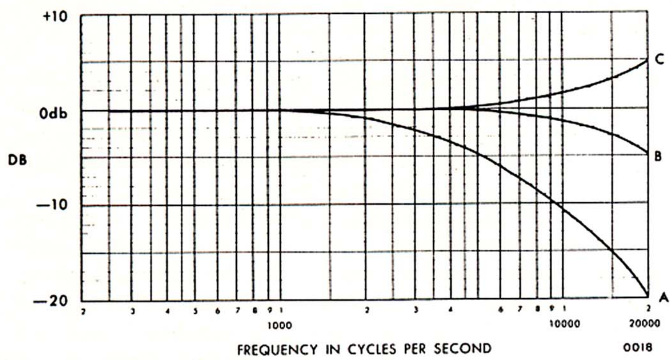
would provide a system with a greater signal-to-noise ratio.

AMPEX engineers therefore devised a 15 ips equalization known as AMPEX Master Equalization (AME) wherein a post-emphasis is designed to minimize audible noise, and then the pre-emphasis is employed to make the overall system flat. AME admittedly trades overload margin for a lower noise level, and must be properly used to obtain the intended results without distortion. It is intended for professional use, such as the recording industry, and is not to be considered as supplanting the NAB standard for publicly released tapes.

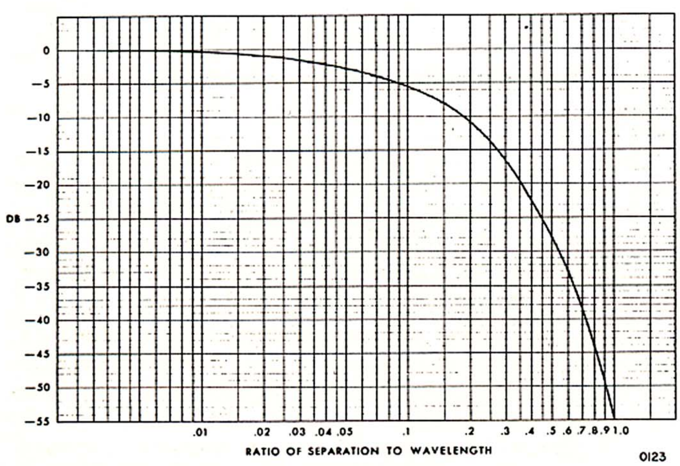


This graph shows how a flat overall frequency response is achieved. Curve A is an "ideal" record-reproduce response. Curve B is the result of adding the standard NAB post-emphasis to the ideal response. Curve C indicates the amount of record pre-emphasis needed to achieve flat response. As the post-emphasis curve is established as a standard, any deviation from the ideal response must be accompanied by a change in pre-emphasis.

FREQUENCY RESPONSE

Head-To-Tape Contact

A knowledge of the effects of losing good head-to-tape contact will help us realize the importance of



This curve indicates the result of poor head-to-tape contact as a function of the amount of separation and the signal wavelength.

maintaining good contact. The predicted loss in separating the reproduce head from the surface of the medium is 54.6 db per wavelength separation. Thus at short wavelengths, say ½ mil (15,000 cps at 7½ ips), it takes very little space to result in a 5 db loss in signal strength. When we remember that commensurate losses also could occur in the record mode, it becomes evident why good contact is a major consideration in achieving top performance in a magnetic tape recorder.

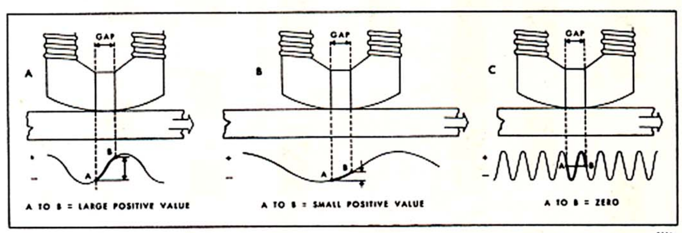
High Frequency Response

In audio applications, and at tape speeds normally used in professional work, the high frequency response is almost entirely limited by the tape and magnetic heads, in what are referred to as "wavelength losses". Despite numerous tomes attempting to explain these losses they are as yet not fully understood, and we would be presumptuous if we attempted any explanation on this plane.

As our high frequency requirement rises — in video or instrumentation applications — or as our tape speed is lowered, we enter a region where the dimensions of the reproduce head gap, and the resonant frequency of the heads become important factors.

Gap Effect

As shown on the accompanying diagram, when the recorded frequency rises to a degree where the reproduce head gap intercepts a complete wavelength of the signal on the tape, there can be no difference in flux magnitude across the gap, and the head output will be reduced to zero. Practically, this will occur at the "effective" gap length, which is slightly longer than the physical length. For all practicable purposes this effect causes the head output at this frequency and above to be useless.



In this illustration sinusoidal waveforms are used to denote the average state of tape magnetization and to indicate how the reproduce head gap derives a large output from a medium wavelength signal (A), a small output from a long wavelength signal (B), or no output when the wavelength equals the gap length (C).

Two methods may be employed to counteract this "gap" effect — either the gap can be made smaller or the record-reproduce tape speed can be increased. We can reduce the dimension of the gap only so far and retain adequate signal levels and realistic manufacturing tolerances; as this point is reached any further extension of high frequency response must be accompanied by a corresponding increase in tape speed.